ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 18, No. 21. WEEKLY.

NEW YORK, SATURDAY, JULY 18, 1891.

$3 per annum. Single Copies, 10 Cents.

Copyright, 1891, by ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

Let somebody apply an electric heater operated by storage batteries for use in car riages.

With Captain Zalinski's pneumatic dynamite gun company in liquidation and himself under arrest for a trespass on the red-tape rules of a martinet who seems to think the uniform makes the soldier, the brainy soldier seems more than ever to have missed in his native Republic the appreciation monarchies have been only too willing to bestow on him.—*New York World.*

The electrical executions afforded material for many gossips and chats among electrical people last week. Naturally the consensus of opinion is decidedly against the prostitution of electricity to such base uses. Mr. George Westinghouse, Jr., said: "Of course, a Westinghouse dynamo will kill a man. But these prison officials don't work it right. The correct way is to carry the dynamo to the top of a four-story building, and then drop it on the criminal, who is placed on the sidewalk below. Any kind of a sidewalk will do. Owing to its compact size and form the Westinghouse dynamo is well adapted to kill people—when used as I have indicated."

Mr. Stephen D. Field remarked: "A better method of killing criminals than shocking them to death, is to smother them in melted butter."

Another man said: "The able talent employed by the State to conduct these executions gives me 'that tired feeling.' No one will be electrocuted properly until a first-class electrical expert is employed to do the job. And that will be the next day after never."

Dr. R. S. Tracey has just submitted the annual report of the New York Board of Health. During the past year there were 1,333 deaths in New York caused by accident or negligence. Electricity is charged with causing but two of this large number of deaths.

About a month ago the office of the A. Westman Mercantile Company, of Pueblo, Colo., was run into and completely demolished by an electric car. The company has recently moved into a new office, an exact duplicate of the one demolished. The following sign adorns the front of the building: "Hereafter electric cars must secure permits before entering this building."

In New York we refuse to have wires overhead, and in New Orleans they refuse to have them underground. In New York there is a big subway company, in New Orleans a big pole company. It is not a question of latitude; merely one of influence. —*New York Commercial Advertiser.*

The telephone in Jim Mershon's saloon, on the corner of Lafayette and Floyd streets, suddenly caught fire last evening, scorching Mershon's face and nearly putting out his eyes. He was talking through the telephone when a blaze burst from the box and surrounded the instrument.—*Louisville, Ky., Courier-Journal.*

Jim has learned a lesson. Hereafter he will not talk into a telephone just after drinking his own whiskey.

The Fort Worth *Gazette* argues from the fact that if a human body is charged with electricity the hair of the head will stand on end, that chickens may be picked of their feathers by electricity. It will not be surprising to learn from the *Gazette's* columns that two and two make five.

The British admiralty has resolved to give $20,000 to Admiral Colomb for his invention for flashing night signals.

A Brooklyn Electric Road.

One of the most thoroughly equipped and successful electric railways it has ever been our pleasure to describe is that recently built by the Brooklyn City Railroad Company, from Thirty-ninth street and Second avenue, South Brooklyn, to Gravesend Bay. The plant consists of a temporary power station, a large car house, seven miles of double track, twenty 18-foot motor cars, and 20 open trail cars.

The steam plant consists of two McIntosh & Seymour 400 horse-power high speed engines, making 200 revolutions a minute.

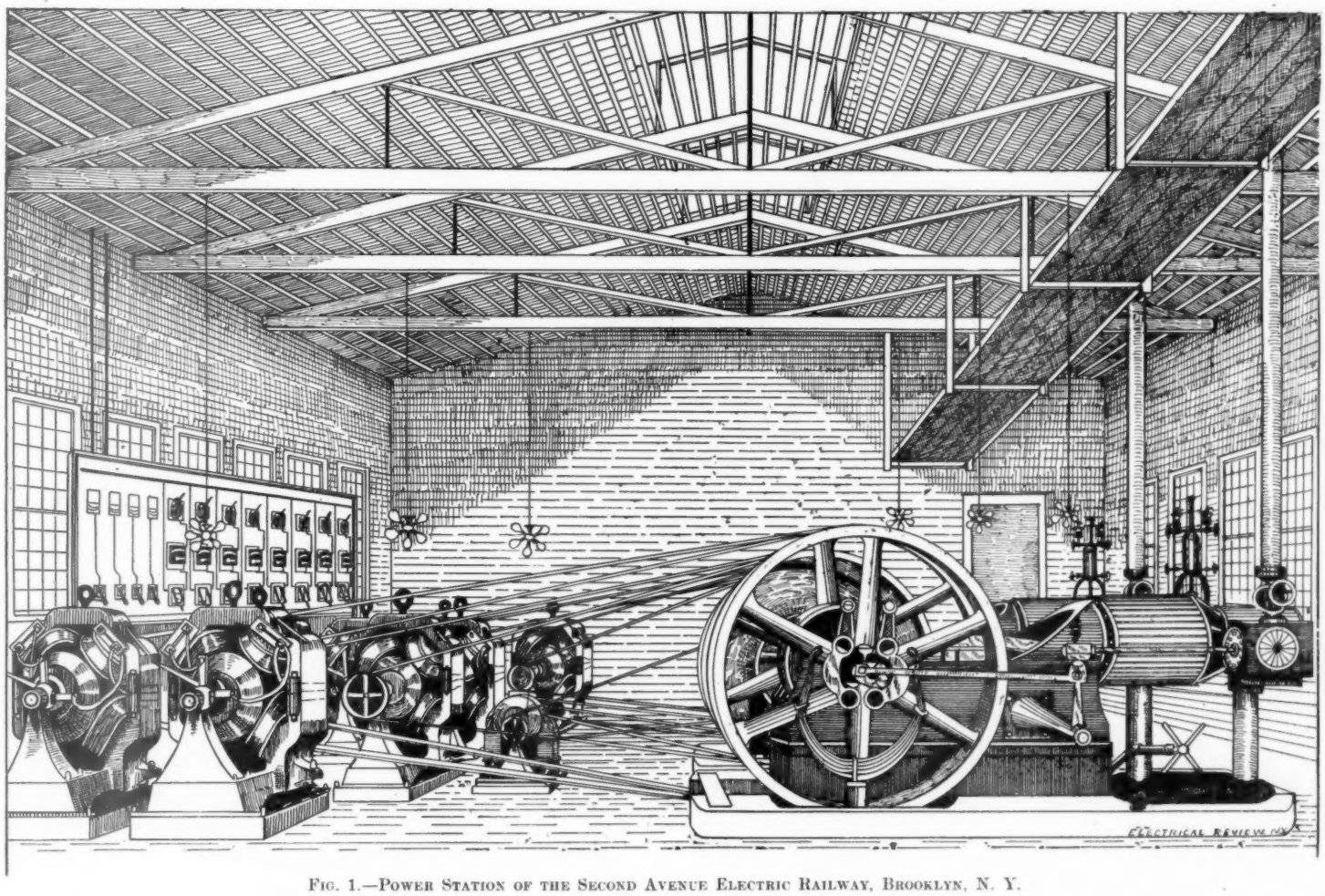


FIG. 1.—POWER STATION OF THE SECOND AVENUE ELECTRIC RAILWAY, BROOKLYN, N. Y.

Each engine is equipped with two driving wheels seven feet in diameter, and 24-inch face. An auxiliary driving wheel is attached to one side of each engine to run an exciter. These engines are of a new type with extension bases and of heavier build than usual.

Steam is generated at 160 pounds by two Babcock & Wilcox 400 horse-power special high pressure boilers. The exhaust passes through a 500 horse-power National feed-water heater, and the steam pipes are fitted with Pearson separators. The piping is arranged so that the power may be increased at any time.

A system of automatic oiling has been installed. The waste oil runs from the engines and pumps to a central tank under the

"Down the Slope" is the name of a "great realistic and sensational comedy-drama" that goes out on the road next season. It is said to be a picture of life among the miners, and one of its features will be an electric mining machine in operation.

floor of the engine room; from here it is pumped back through a filter to a tank on the top of the building; thence it is fed down to the engines and used over again.

Two Davidson steam pumps and a Hancock inspirator form a part of the steam plant. All the pumping apparatus is constructed in duplicate. Schieren's perforated electric leather belting is used.

Current at 500 volts is furnished by eight 100 horse-power Thomson-Houston generators, making 750 revolutions per minute. A wooden switchboard fitted with Thomson-Houston apparatus, as shown in our illustration on the first page, is used. A novel form of lightning arrester, originally adopted by the West End Street Railway Company, of Boston, is installed here. The cables are carried from the generators up over the switchboard, and then down through split iron pipes. At the top of each pipe a metallic cone is placed, the wires running inside of the cone into the pipe, and then through a Thomson-Houston lightning arrester. The theory of the device is that the charge is split up by the cone and carried outside of the cable by the iron pipe.

The car house is a handsome frame structure 350x100 feet and well equipped. A Lewis & Fowler transfer table operated by a Thomson-Houston motor, is almost completed. Pits to repair or clean 35 cars at once are located in the rear end of the car house. There is also a wash room where four cars can be washed at one time. A very complete repair shop, where all electrical and mechanical repairs will be made, is being fitted up. A 10 horse-power Thomson-Houston motor will furnish power for the machine tools in the shop.

The cars were all made by the Lewis & Fowler Manufacturing Company, of Brooklyn, and each motor car is equipped with two 15 horse-power S. R. G. Thomson-Houston motors. The cars are almost black in color, picked out in gold, and make an exceedingly handsome appearance. The Boston trolley pole and stand are used. The track is laid with Lewis & Fowler 65-pound girder rails. The trolley wire is supported by tubular iron poles, and the return wire is of large capacity.

As stated before, the power-house is a temporary affair. A permanent brick structure is to be located in the rear of the car house, very near the bay.

The entire equipment of this line is of the highest order of excellence, which may be fully understood when it is stated that Mr. F. S. Pearson, of Boston, acted as consulting engineer. Mr. Robert Brown is superintendent of the road, Mr. Milton Staritt is chief electrical engineer, and Mr. James Anderson, chief mechanical engineer.

The road runs through a beautiful suburban section, which has reached its present development owing to the building of the line. A high rate of speed is attained on some portions of the road, and first-class rapid transit facilities are furnished the residents of this new locality. The road was opened on the thirtieth of May last, and has carried as high as 15,000 passengers in one day.

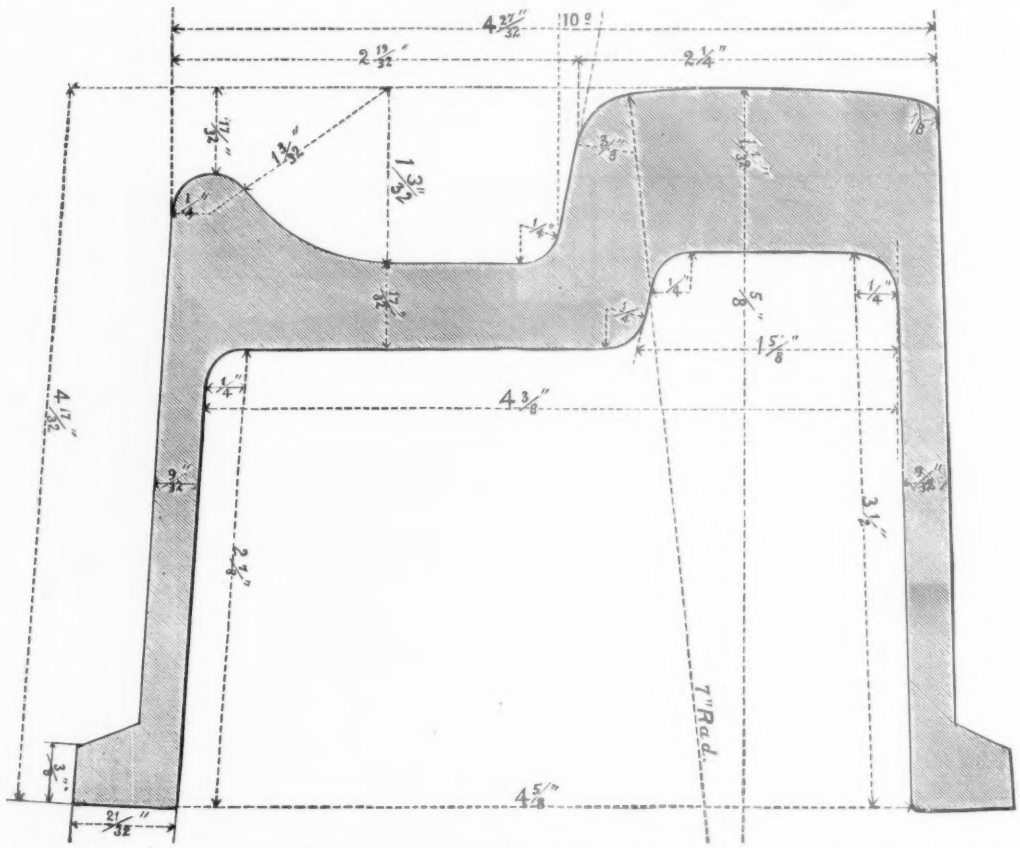


FIG. 2.—LEWIS & FOWLER RAIL, USED ON THE SECOND AVENUE ELECTRIC RAILWAY, BROOKLYN, N. Y.

World's Fair News.

One of the novel buildings at the Exposition will be the Casino and pier. The Casino, which will stand out in the lake 1,000 feet from the shore, is intended to reproduce Venice on a small scale in Lake Michigan. Burling and Whitehouse, of Chicago, have completed the design for this structure, and the architecture is, of course, of Venetian order.

The Casino will be built on piles, and connected with the shore by a pier 80 feet wide. The base dimensions of the Casino will be 180x400 feet. The building will consist of nine pavilions, two stories in height, and, with the exception of the central one, 80 feet above the surface of the water. The center pavilion will be 180 feet high. There will be communication between the nine pavilions both by gondolas and bridges. Completely surrounded by water, this structure, with its fleet of boats and numerous waterways, is expected to have a decidedly Venetian flavor. Surrounding the central pavilion will run a gallery 56 feet wide. The pier connecting the Casino with the shore will form a broad promenade. At the west end of the pier will stand the 13 columns designed by sculptor St. Gaudens to represent the thirteen original States. In front of the Casino will be a harbor for small pleasure craft. At night this harbor will be lighted by incandescent lamps sunk beneath the surface of the water on floats. The material of the Casino will be of wood, and the walls will be covered with staff. A striking combination of high colorings will be effected. The contract for the construction of the pier and Casino has been let.

Railroad Slaughter.

No other term can be applied to the terrible catastrophe which happened recently at Ravenna. To call such an atrocious affair an "accident" is a sinful misuse of the English language, a shameful cloak which criminally negligent railroad directors have too long been allowed to throw over their barbarous policy of indifference to the safety of human life. Periodically the country is thrilled with horror by some such cruel slaughter as that which sickened every home in the United States last week, and still the directors of railroads are allowed to go on sending hundreds of their fellow beings to their deaths every year, making scapegoats of their brakemen and conductors and allowing the responsibility to be placed anywhere, except where it belongs—on their own shoulders.

If a proper system of signaling had been in use on the Erie road, the massacre at Ravenna could never have taken place, and the blood of all the poor victims who were murdered on that awful night is on the heads of the directors who omitted to provide that system of signaling. The same might be said of any one of the half dozen railway catastrophes that have occurred during the past year or two; every time that 20 or 30 innocent persons are hurried into eternity in a more or less horrible manner there is a great outcry and demand for investigation, and for somebody to be indicted, but nothing is ever done and railroad directors go on slaughtering.

We have repeatedly pointed out that until the block system is generally adopted and efficient telegraph service is maintained on our great railways, these "accidents" will continue to occur at more or less frequent intervals. It would seem that it is almost time to compel the directors of railroad corporations to take all the precautions that science has provided to ensure the safety of travelers. Railroad men are too apt to look down on electricity and scorn its powerful aid. Until a few of them are indicted and sentenced for manslaughter, they will continue to sacrifice life in order to increase their dividends.

Long Distance Love Making.

"Why, where's your ring," said one telephone girl to another; "aren't you engaged to Charlie Slow?"

"I used to be," replied the other, "but he insisted on kissing me through the 'phone, so I had to ring off."—*Binghamton Republican.*

COMMENTS OF THE PRESS.

MORE HORRIBLE THAN ANY WHICH HUMAN CRUELTY HAS AS YET DEVISED.

[*From the Morning Advertiser.*]

In the absence of those details which the presence of reporters would properly have furnished for the public, we have only the general statement that the execution was a "success." There was a suspicious, apparently needless, delay of several minutes between the killing of the men, one after the other, when the whole four in separate chairs might have been simultaneously shocked and slaughtered. The entire time thus occupied was one hour and 23½ minutes, or longer than is required to slaughter more than 100 hogs in the Chicago shambles.

Enough of this shocking story is made public to show that this method of capital punishment is more horrible than any which human cruelty has as yet devised. The deliberate and hideous preparations, the prolonged preliminary mental torture of the victims, the theatrical parade of the warden and his keepers with bulldogs and rifles, the secrecy which suggests the uncertainty on the part of the executioners of the success of their still confessed "experiment," the taking of the men, one after the other, out of their cells and so keeping up the killing for the entertainment of the witnesses for nearly one hour and a half—all these are not calculated to impress the public in favor of this modern method. From beginning to end it is simply revolting, and is a reflection upon a people who claim to be civilized.

So long as it shall be considered necessary to legally put men to death—and exhibitions like the electrocution of yesterday will materially tend to shorten the period of such public opinion—some better and more merciful method should be devised than this hideous "death chair."

THINKS THE DEED WELL DONE, BUT DON'T LIKE WARDEN BROWN.

[*From the N. Y. Times.*]

This whole proceeding was deprived of the impressiveness and solemnity intended by the law and turned into burlesque by Warden Brown's officiousness. If he had contented himself with refusing to give information and excluding from the prison all but the designated and selected witnesses, he would have done his full duty. What information others might give out was none of his business, and he had no lawful right to bind any man to secrecy, and the wonder is that reputable physicians, clergymen and other citizens would submit to any pledge from him. Newspapers are prohibited from publishing details of the execution, but nobody is by law prohibited from giving them out, and the newspapers are quite capable of taking care of their own responsibility and liability in the premises, and need no protection from the prison officials. It is simply impossible to prevent the publication of what purports to be the details of these executions, and it would be much better to permit authentic accounts to be given than to leave them to the invention of irresponsible reporters, some of whom may circulate mischievous statements. The result at Sing Sing yesterday seems to have demonstrated the entire success of executing the death penalty by the electric current, the utter folly of the provision of the law prohibiting the publication of details, and the peculiar unfitness of Warden Brown for any public duty requiring tact, good sense, and a decent regard for the rights of law-abiding citizens.

THE SECRET TORTURE CHAMBER.

[*From the Brooklyn Standard-Union.*]

The new killing machine worked pretty well this morning, but the officials have managed to get up a mysterious muddle on the subject that is offensive. It was a stupidity not to admit the reporters—the witnesses for the people. The change in the method of execution was prompted by notions that there was humanity in it; but

if it has any merit, it is that the death chair impresses the public as more terrible than the gallows.

AN ADVANCE IN PAST METHODS.

[*From the N. Y. Tribune.*]

Undoubtedly the execution of Kemmler at Auburn last year was mismanaged, and it is even now impossible to say who was at fault. The probability is that he died a painless death at the very second of time when the first current entered his body, that the second current was unnecessary, and that most of the "horrors" which were so minutely described as attending the execution occurred only in the imagination of those who furnished the accounts of them to the newspaper men. But the public, in reaching its judgment as to the wisdom of the new law, should not be dependent upon probabilities. It is entitled to know what the facts are, to know at once, and to know through the newspapers which have no motive to misrepresent. It is foolish to pretend in these days that the public's ends can be as well served by the official reports.

The facts concerning these executions should be as open and as easily obtainable as any other facts appertaining to a matter done on the public behalf. Those newspapers which are so constituted as to delight in sensation will pursue their policy. Those that prefer to tell the truth will tell the truth. The public appreciates each sort at its proper value. The press no more than the public is to be improved by law. Its improvement comes as the result of the same moral forces that work continually for the regeneration of the community.

The new law will gain many friends in consequence of these last executions. The time within which they were accomplished is of itself telling proof that the electrical method is a great advance upon the method of the past. At the same time there is a growing prejudice against that feature of the law which sets the date of the killing indefinitely and leaves it within the limits of a full week at the option of jailers. It is felt with good reason that this is a cruel provision, and that nothing is gained for justice or mercy by extending the horrors and terrors of the last struggle through a week when they might be confined within a few hours of a single day.

LET THE NEWSPAPERS MAKE THE ISSUE.

[*From the N. Y. Sun.*]

This morning the *Sun* and every other real newspaper in the State openly and deliberately violate that section of the electrical execution law which forbids the publication of the details of an execution:

"No account of the details of any such execution, beyond the statement of the fact that such convict was, on the day in question, duly executed according to law at the prison, shall be published in any newspaper. Any person who shall violate or omit to comply with any provision of this section shall be guilty of a misdemeanor."

This provision, intended by the cranks who framed it to throw around the death chamber and the death chair a mystery like that surrounding a torture room of the middle ages, stands in the statutes as a disgrace to the civilization of which we are proud. It is against public policy, it is impossible to enforce, and it is defied and will continue to be defied by every self-respecting newspaper in New York on every such occasion as the execution of Kemmler at Auburn 11 months ago, and the killing at Sing Sing yesterday morning of Slocum, Wood, Smiler and the Japanese, Jugiro.

The law which vainly seeks to restrain the press of New York in the performance of a public duty of the first importance, itself defies a higher law, namely, the Constitution of New York. In the bill of rights which constitutes Article I of the Constitution, and which catalogues the most precious heritages of a freedom gained by blood, it is agreed and forever decreed that "no law shall be passed to restrain or abridge the liberty of speech or of the press."

The free press knows its duty and its power; and so long as the unconstitutional prohibition stands as part of the electrical execution law, that part of the law will be disobeyed by the newspapers of New York, universally, deliberately and rightly.

But the press of this State has another duty to perform, even more important than its periodical self-subjection to prosecution for a righteous misdemeanor. It must bring about the repeal of this unconstitutional provision, insulting to the very name of American liberty. To that end it should devote its utmost energies at the next election. Without regard to personal or partisan considerations, it should support for the legislature and for responsible executive posts only such candidates as are distinctly committed against this preposterous revival of mediæval principles, and pledged to help in sweeping the press-gag law from the statute book.

Until that is accomplished, a black stain rests upon the fame of the New York press. Is there any journalist in the State, republican or democratic, who does not account the priceless right of free utterance as far above any temporary issue which partisanship can devise? For the good name of our profession, we hope not. The *Sun* is ready, for one, to engage itself to support any republican candidate who shall promise to vote or work next Winter for the repeal of the foolish and unconstitutional law which strikes at the liberty of the press, as against any democrat who shall refuse or omit to put himself on record for free speech and a free press.

FLAYS THE WARDEN.

[*From the N. Y. World.*]

The warden of Sing Sing prison took extraordinary and wholly unnecessary as well as futile pains to prevent the newspapers from getting news of the electric executions which took place there yesterday morning.

The warden evidently mistakes his function and magnifies his office. The statute which forbids newspapers to publish the news of executions is like any other statute. It is for the courts to enforce, not for the warden of a prison to execute.

It is the warden's business simply to perform the executions in secret, restricting the number of witnesses as the law requires. It is not his business to pledge the witnesses to secrecy or to resort to any other unusual devices to prevent news "leaking out."

If any newspaper editor publishes news which he is forbidden by the statute to publish, that is the business of the district attorney, the grand jury and the courts. The act is made a misdemeanor by the statute. The man committing it is subject to trial and, if the statute is constitutional, which we do not believe, to punishment.

There is law for all that. But there is no law making it the duty of a warden to guard the avenues of news against responsible newspapers. To do so it is to do a superserviceable act, hostile to the people, who have a right to know what is judicially done in their name.

New Electric Railway in Michigan.

The Marquette City & Presque Isle Railway Company, which is operating the Thomson-Houston system, has recently been put in operation. This line comprises three miles of track, and is at present operating three motor cars. This is the first road in Michigan equipped by the Thomson-Houston Electric Company, and if its first day's operation is any criterion for what is to follow, it will be eminently successful.

EDISON ELECTRIC PERCUSSION DRILL AT WARDNER, IDAHO.

Edison Percussion Drill.

This drill, which has already been described in the REVIEW, is in use in a large number of Western mines. Our illustration shows a drill in the Last Chance Mine at Wardner, Idaho. The engineer in charge writes as follows: "Operating two air drills for 24 hours, required five cords of wood, while for running four electric percussion drills for the same length of time, each drill doing more work than the air drills, it required only one and one-half cords of wood. The electric percussion drills have been found to do more work than the air drills, and in consequence the air drills have been replaced by electric drills.

"The air plant was situated 1,000 feet higher up the mountain than was required with the electric drill, and the fuel had to be carried to the air plant this increased distance over that necessary for the electric percussion drill."

NEW CORPORATIONS

Lynchburg, Va.—Southern Electric Company; capital, $25,000.

Hoboken, N. J.—Lieb Insulating Company; capital, $50,000.

Monticello, Ia.—The Monticello Electric Company; capital, $8,000.

Baltimore, Md.—Ries Electric Specialty Company; capital, $25,000.

Portland, Me.—Cumberland Illuminating Company; capital, $25,000.

Chicago, Ill.—Royal Carriage Telephone Company; capital, $10,000.

Clinton, N. J.—Clinton Illuminating and Power Company; capital, $10,000.

Columbus, O.—The Columbus Electric Railway Company; capital, $100,000.

Plattville, Wis.—The Plattville Electric Light and Power Company; capital, $10,000.

Shenandoah, Ia.—Shenandoah Electric Light and Power Company; capital, $15,000.

Jersey City, N. J.—The Greathead Tunnel and Subway Company; capital, $500,000.

Topeka, Kan.—The Topeka Water and Electric Power Company; capital, $500,000.

Ellsworth, Me.—Hancock County Telephone and Telegraph Company; capital, $12,000.

Augusta, Me.—Central Maine Shaver Molecular Telephone Company; capital, $50,000.

Pittsburgh, Pa.—The City Traction Company, to operate an electric railway; capital, $25,000.

Washington, D. C.—The National Electric Company, incorporated in Virginia; capital, $1,000,000.

Albuquerque, N. M.—The European Silico-Mica Composition Company; capital, $1,000,000.

Pana, Ill.—The Pana Modern Electric Light, Power and Street Railway Company; capital, $50,000.

Livingston, Mont.—Livingston Water Power Company, to construct canals, ditches, street railways, electric light plants, etc.; capital, $250,000.

Newark, N. J.—The Bachr Electric Manufacturing Company. Capital $50,000. The incorporators are George Baehr, Samuel O'Conner and Charles F. Perry, of Brooklyn, and Henry Rohliffs, of Newark.

The Latest Figures.

Whipple's Reports, for July, furnishes the following information:

CENTRAL STATION COMPANIES.	
Stations in United States	1,763
" Canada	142
" Cuba	1
" Mexico	10
Total Stations	1,916
GAS COMPANIES.	
Companies in United States	977
" Canada	49
" Mexico	1
Total	1,027
Companies operating Electric Lights, U. S.	283
" " " " Canada	20
" " " " Mexico	1
Total	304
STREET RAILWAY COMPANIES.	
Companies in United States	936
" Canada	26
Total	962
Electric Roads in Operation and under Contract in United States	310
Electric Roads in Operation and under Contract in Canada	6
Total	316
Cable Roads in the United States	48

Electricity has superseded mule power on the Marion, Ind., street railway, and the company has five miles in operation. Fifteen additional miles are in process of construction.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 3329. NEW YORK.

EDITOR:
CHARLES W. PRICE.
ASSOCIATE EDITORS:
STEPHEN L. COLES.
ROBERT H. READ.

REGISTERED CABLE ADDRESS:
"ELECTVIEW." NEW YORK.

"1546 CORTLANDT." TELEPHONE CALL.

BOSTON OFFICE:
W. I. BARKER, Room 29, 620 Atlantic Ave.
WASHINGTON OFFICE:
GEO. C. MAYNARD, 1409 New York Ave.
CHICAGO OFFICE:
L. W. COLLINS, 435 "The Rookery."

EUROPEAN OFFICE:
CHARLES FFRENCH, Editor for Europe.
HOTEL VICTORIA,
Northumberland Ave., Charing Cross, London, W. C.

Cable Address: - - "Electview," London.
Telegraphic Address: Ffrench, "Victoriola," London.

ADVERTISING DEPARTMENT,
H. T. RICHARDS, Manager.

PATENT BUREAU,
ROBT. H. READ, Manager.
Patents procured in United States and all foreign countries. Searches, Investigations and Reports on Validity and Infringement.

SUBSCRIPTION TO THE
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - .10

ANNOUNCEMENT.

Address all communications and make all money orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

No attention will be paid to communications for the REVIEW without the *name and address of the writer.*

NEW YORK, JULY 18, 1891.

CONTENTS.

	PAGE.
Views, News and Interviews	273
A Brooklyn Electric Road	273
World's Fair News	274
Railroad Slaughter	274
Long Distance Love Making	274
Comments of the Press	274
New Electric Railway in Michigan	275
Edison Percussion Drill	275
New Corporations	275
The Latest Figures	275
The Sing Sing Execution	276
Look on this Picture and on That	276
Correspondence:	
Our Boston Letter	277
Our Chicago Letter	277
Our Cincinnati Letter	277
Our Kansas City Letter	277
The New York Electrical Society Meets at Eldorado	277
Repeal the Electrocution Law	277
Telephonic News	278
A Large Engine Order	278
Tesla's Incandescent Lamp	278
Literary	278
Improvement in Carbon Brushes	278
Card Electric Dynamo & Motor Company's Fan Outfit	278
Our St. Louis Letter	278
The Blackening of Incandescent Lamps	278
The Cincinnati Tool Company's Combination Lineman's Pliers	279
Telegraphy from the Grave	279
Telegraphic	279
The State of Massachusetts *vs.* the Western Union	279
Electric Lighting of St. John, N. B.	279
Electric Power	280
500-Volt Fan Motor	280
Queen & Company's Tachometers	280
Jenney Dynamo, Motor and Power Generator	280
Personal	280
Electric Resonance	281
Westinghouse Lightning Arrester	281
Electric Light News	281
Electrical Evaporation	282
Newspaper Advertising	283
Kindred Interests	284
Electrical Patents	284

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE.
Alexander, Barney & Chapin	xix
Ansonia Brass & Copper Co	xx
Armington & Sims	xx
Brush Electric Co	xix
Bridgeport Brass Co	xx
Day's Kerite Insulated Wires	xx
Eastern Electric Cable Co	xx
Hampson & Co., E. P	xx
Jewell Belting Co	xx
Johns Mfg. Co., H. W	xx
Keasbey, Robert A	xx
Moore, Alfred F	xx
Okonite Co	xx
Schuyler Electric Co	xix
Standard Underground Cable Co	xx
Tucker Electrical Construction Co	xx
Wainright Mfg. of Mass	ii
Wilmot & Hobbs Mfg. Co	xx

INSIDE PAGES.

Allentown Foundry and Machine Co	284
American Bell Telephone Co	xvii
American Casualty Insurance and Security Co	xii
American Circular Loom Co	viii
American Electrical Works	xi
American Electric Elevator Co	vii
Baker & Co	vi
Ball Engine Co	vi
Ball & Wood Co	vi
Barnes Co., W. F. & John	vi
Barr Electric Manufacturing Co	xii
Berlin Iron Bridge Co	xi
Billings & Spencer Co	xiv
Bishop Gutta-Percha Co	xiii
Brill Co., J. G	xvii
Brownlee & Co	iv
Buckeye Engine Co	vi
Bunnell & Co., J. H	284
Burton Electric Co	xii
Bush Co	ix
"C. & C." Electric Motor Co	xvii
Central Electric Co	iv
Claflin & Kimball	x
Cralle & Co., J. B	xv
Crocker-Wheeler Motor Co	xii
Dixon Crucible Co	xvii
Dwight Slate Machine Co	xv
Eastman Co., The	xi
Edison General Electric Co	iv & xvi
Electrical Engineering Co	284
Electric Construction & Supply Co	xiii
Electric Secret Service Co	iv
Empire China Works	vii
Equitable Engineering & Construction Co	viii
Eureka Electric Co	x
Evans Friction Cone Co	x
Faraday Carbon Co	iv
Fay, Thos. J	xii
Fletcher & Fletcher Electric Co	xvii
Fort Wayne Electric Co	xviii
Foundry & Machine Department, Harrisburgh Car Mfg. Co	vi
Garvin Machine Co	vi
Gordon & Co., W. H	xii
Greeley & Co., The E. S	xvii
Haines, Jones & Cadbury Co	vi
Hay-Horn Mfg. Co	284
Hazelton Tripod Boiler Co	viii
Holmes, Booth & Haydens	iv
Holtzer-Cabot Electric Co	xv
Hood, Wm	vii
Independent Bung Co	xiv
Kulp, D. H	xvii
Ladd, Alfred W	vii
Lane & Bodley Co	xvii
Law Telephone Co	284
Leclanche Battery Co	xi
Leffel & Co., James	ix
Lehigh Valley Creosoting Co	vii
Marshall, Wm	xvii
Mason, J. W	xi
National Electric Mfg. Co	iii
National Electrical Mfg. Co	xviii
National Carbon Co	iv
New England Butt Co	vii
New York and Ohio Co	viii
New York Belting and Packing Co	xiv
New York Insulated Wire Co	xv
New York Safety Steam Power Co	vi
Noye Mfg. Co., John T	vi
Ostrander & Co., W. R	ix
Paiste, H. T	x
Parker-Russell Mining and Manufacturing Co	xiv
Partrick & Carter Co	x
Phœnix Glass Co	xii
Phosphor-Bronze Smelting Co., Ltd	xv
Pond Engineering Co	vi
Pray, Jr., Thos	xi
Prentiss Tool & Supply Co	284
Queen & Co	284
Reddaway & Co., F	ix
R. I. Telephone & Electric Co	284
Ridlon, Frank	284
Royce & Marsean	xv
Russell Electric Co	x
Sawyer-Man Electric Co	ix
Schieren & Co., Chas. A	284
Sessions Foundry Co	ix
Sigourney Tool Co	xvii
Solar Carbon & Mfg. Co	vi
Standard Paint Co	viii
Stanley & Hall	vii
Stanley Electric Mfg. Co	xi
Star Iron Tower Co	xii
Stephenson Co., John	xii
Thomson-Houston Electric Co	xiv
Tropical American Telephone Co	v
Truex & Vail	xvii
Union Electric Mfg. Co	v
United States Electric Lighting Co	xv
Universal Arc Lamp Co	x
Washburn & Moen Manufacturing Co	viii
Watson & Stillman	vii
Wennstrom, John	284
Western Electric Co	iv
Weston Electrical Instrument Co	xiv
Whipple Co., Fred H	xviii
White Dental Manufacturing Co., The S. S	xiii
Whitmore & Robinson	xi
Williams & Potter	ix
Woodhouse & Rawson	viii
Wyckoff, Seamans & Benedict	284

Query for electricians: Which would you rather be—the man who touched the button, or the man who did the rest?

Have the people of New York been sufficiently satisfied that electrocution is not a humane mode of killing criminals? Five roastings should certainly prove this. A politician could make good use of the party cry, "Repeal the electrical execution law!"

There is suspicion that the walls of Sing Sing penitentiary contain an unpleasant secret. If it should transpire that the convicts killed by the electric current were first drugged to make them docile, the query would naturally arise, why not slightly increase the dose? Then neither rope, nor wire, nor guillotine would be necessary.

A correspondent in the *Medical Summary*, commenting upon sciatica, says that if the positive pole of a galvanic battery, having the pole (carbon preferred) covered with absorbent cotton and moistened with chloroform, be put over the painful parts, and five to ten milliamperes of current passed through it, using every other day for a short time, a cure will be effected, providing there is no constitutional trouble. The negative pole can be applied at any suitable place.

In no one branch of the industry has the quick wit of the electrical fraternity been more conspicuous than that devoted to advertising. Many new, interesting and striking methods of attracting attention from the busy public may be traced to the alert minds of electrical men, and these announcements either in the press or catalogue carry with them the impression that they speak of that which is of value, else they would be silent. In the REVIEW this week begins an Advertising Forum, from which gentlemen of ability and experience in this particular field will give their views from week to week. We think too much care and attention can never be given to the question of the best manner to let the public know what you have for sale to them and for their benefit, and we are sure that many new and valuable ideas will be presented in this discussion in the REVIEW, which begins with an interesting paper from the pen of Mr. Walter F. Smith, general manager of the Heisler Electric Company, Philadelphia.

THE SING SING EXECUTION.

Four men guilty of murder were secretly killed at the Sing Sing, N. Y., penitentiary Tuesday morning of last week, as we briefly announced in our last issue. The witnesses, it is said, were compelled to take an oath of secrecy before they were permitted to attend.

The men executed were Joseph Wood, Harris A. Smiler, James Slocum, and Shibuya Jugiro. A death chair was provided, and the convicts strapped in one at a time, the electrodes being placed at the head and leg of each. Death is said to have been instantaneous, yet there is a general report that two shocks were administered in each case. A current of 1,600 volts was said to have been administered.

Aside from the killing of these men, the most conspicuous feature seems to have been the action of Warden Brown, who succeeded in getting himself quite thoroughly disliked. What the press thinks of Warden Brown is evidenced by the gentle mention we quote in another column.

Warden Durston, of Auburn, N. Y., who executed Kemmler, was present at the Sing Sing executions. Mr. Durston was a New York visitor Thursday of last week and in a casual chat with a REVIEW representative expressed himself as still strongly in favor of the rope as against the electric wire, and further said that if electrical executions continued he hoped that the plan suggested by Mr. Edison, *i. e.*, to send the current from hand to hand directly through the heart, would be tried. Although Mr. Durston was quite guarded in his remarks, it was evident from the above and from other statements that he was not a believer in electrical executions nor was he prepared to pronounce the ones he had seen successful in every way.

LOOK ON THIS PICTURE AND ON THAT.

The July number of the *Century Magazine* contains an interesting and elaborate article from the pen of Mr. Albert Shaw on "Paris, the Typical Modern City." A considerable portion of Mr. Shaw's article is devoted to a description of the electric lighting in Paris and the disposition of the underground wires for the various electric services of the city. Some passages of this description are worthy of quotation and comment. We are told that:

"The question how to dispose of the wires—a question that makes so vast and so continually recurring an agitation in all American cities—never comes up at all in Paris, and is seldom mentioned in any European city. There are absolutely no obstructive wires in Paris. The government has purchased the telephone as well as the telegraph system, and all the wires for those services are placed in the subways or sewers. The wires of the electric companies are buried under the sidewalks. Armored cables are laid in simple conduits, or even in the bare soil, without the slightest difficulty from any point of view. * * * * The whole city of Paris will have been laid with a network of electric lighting cables a few months hence, and traffic on the streets will have suffered a minimum of obstruction, while no injury whatsoever will have been done to pavements."

This is a very charming picture that Mr. Shaw draws of the effective manner in which the underground wire question has been disposed of in Paris, but we are inclined to believe that the coloring is somewhat exaggerated and the detail more than a trifle inaccurate, while the comparison drawn between the simple solution of the difficulty abroad and the chaotic state of the underground question in this country is unfair to electrical men at any rate. It is by no means true that the question of how to dispose of wires "never comes up at all in Paris and is seldom mentioned in any European city." For the past year or two the foreign technical papers have been full of comments on the difficulties of the underground wire question, and these comments have often referred to the bad state of affairs in Paris. Less than a year ago one of the comic papers published in Paris issued a map of the city indicating by a special coloring the streets that were "open," the inference being that the majority were closed (to traffic) on account of upheavals caused by the subway work then in progress in all directions.

Paris has a great advantage over many other large cities in possessing a magnificent system of sewers, in which many wires can be safely accommodated. But the sewers do not reach every point and many subways have had to be built; to pretend that these subways could have been built without disturbing the streets is manifestly absurd. We certainly question the statement that "armored cables are laid in the bare soil without the slightest difficulty from any point of view." Such a system of underground distribution is bound to lead to difficulties from various points of view. Perhaps such cables might be useful for mains connecting one station directly with another, or for feeders between fixed points; but where frequent joints or house connections are necessary armored cables laid directly in the soil are out of the question. In any case they are costly and difficult of access for repairs. With regard to the telephone wires, Mr. Shaw is evidently misinformed, because the telephone system is almost entirely overhead, and the first serious work in underground telephone wire in Paris is just now being begun by the government engineers.

Where Mr. Shaw makes a good point is in his repeated assertion that Paris (with other European cities) is ahead of this country in municipal government and municipal engineering. While many American cities continue to be governed "for boodle only," American citizens will continue to suffer discomfort and inconvenience, to say nothing of far greater ills and wrongs at every hour of their city existence. If the cities were properly represented in the matter the question of how to dispose of the wires could be arranged systematically, methodically, permanently and thoroughly satisfactorily in America as well as in Europe. The electrical profession can bring to bear on the question engineering and scientific talent of the highest order. But this talent is neutralized and obstructed by the ignorant blundering of liquor-sellers, butchers and ticket-agents masquerading as subway "commissioners." If engineer were met by engineer good engineering would be the result. But when engineers are bullied and browbeaten and insulted by men who are ignorant even of technical terms, except as political slang, what can result but chaos and confusion?

Mr. Shaw need pay little heed to his pessimistic electrical friend who informed him that we are five years behind Europe in our electrical methods. Such an amazing statement needs no refutation in a technical journal, and can surely only provoke a smile with the reader even of a popular periodical. In electrical development America cedes priority to no country, although there are, of course, branches of the science where we can learn as well as teach. In the question of municipal government we certainly are behind Europe, and no more convincing proof of the folly we are all guilty of in handing over the control of our towns and cities to gangs of professional politicians and spoilsmen could be desired than the present complicated condition of the underground wire question in New York, and the many vicissitudes which it has experienced during the past few years.

The following is pertinent and prophetic:

"When electricity moves and heats our railway trains there will be no more roasting of people, as happened in the tunnel last February and on the Erie road this July."—*New York World.*

CORRESPONDENCE.

OUR BOSTON LETTER.

Mansfield and Foxboro, Mass., are to be connected by an electric railway within a few months.

An Electric Railway has been projected to run between Worcester, Mass., and Lake Quinsigamond, a distance of about five miles.

The Holtzer-Cabot Electric Company, of this city, has removed its salesrooms and offices from No. 111 Arch street to No. 72 Franklin street.

Mr. Henry B. Cram, president Bernstein Electrical Manufacturing Company, of this city, reports that his line of business is active and prosperous.

Mr. Henry D. Stanley, of the Bridgeport Brass Company, enjoyed a two days' visit among his numerous electrical friends during the present week.

Messrs. Claflin & Kimball, of this city, agents for Perkins lamp and switches and Eastern representatives of the Mather Electric Company, are enjoying a very large business with local and isolated electric light plants throughout the country.

The Wainwright Manufacturing Company of Mass., having offices in this city, has introduced a new feed water heater into the electric lighting field which is attracting considerable attention and much favorable comment. It is a straight tube heater; it possesses peculiar merit and is cheap in price.

Solid Braided Cord for hanging arc lamps and electric street car trolley use, may be purchased from the Samson Cordage Works, No. 115 Congress street, this city. This cord has a widespread reputation for durability, neat appearance and cheapness. It is an excellent armor cord for covering magnets of dynamos.

Mr. F. M. Ferrin, until recently manager of the Boston department of the Standard Electric Company, of Vermont, has established an office at No. 161 Franklin street, this city, and will make it his business to install isolated electric light plants, giving his personal attention to—and supervision of—every order consigned to him. Mr. Ferrin will continue to handle "Standard" dynamos.

Double Bereavement.—Mr. Charles H. Herrick, the general manager of the Wright Electrical Engineering Company, has been doubly bereaved within a fortnight. On the afternoon of June 26 he buried his father, and on the evening of July 10, young Mr. Herrick's wife died, after only a few days sickness. Mr. Herrick is very popular among the electrical interests throughout New England, and his many friends will be grieved to learn of this great misfortune, and all Mr. Herrick's acquaintances will sympathize with him in this, his double bereavement.

Boston, July 11. W. I. B.

OUR CHICAGO LETTER.

Mr. Clift Wise, chief engineer of the Interior Conduit Company, is spending a few days in the city looking over the ground for underground work.

The New Quarters of the Electrical Supply Company, which were fully described in this journal a few weeks ago, have been taken possession of, and though not settled, by any means, the company is doing a rushing business in the new place. An army of workman are busy making necessary changes and fitting up desirable offices for the heads of the many departments.

McFell Electric Company, 182 East Jackson street, constructing contractors, are at present very busy. This company have just been awarded the contract for the wiring and furnishing one of their new McFell guest-call, for the new hotel "Northern," corner Jackson and Dearborn streets. This building is 14 stories high. A 500 number needle annunciator will also be used for the call and return system.

Dean Bros., of Indianapolis, steam pump manufacturers, have been compelled, on account of increase in business, to make arrangements for increasing their plant, and to this end ground has been purchased and contracts made for one of the largest buildings of its kind in the world. The building will be of brick, with a frontage of 1,000 feet, and will start with at least 500 skilled workmen. An immense business is reported by this firm.

Mr. W. F. Matteson, electrician for Mr. Hood, has been out of the city this week superintending the installing of an accumulator plant in the shops of the Atchison, Topeka & Santa Fe Railroad, at Topeka, Kan. Mr. Matteson is not behind the times either, as a salesman having taken since being away some handsome orders for the "Jewel" incandescent lamp. This lamp is rapidly taking its place among the best lamps made.

To Give Our Readers Some Idea of the advancement that has been made during the past four months in the way of interior conduiting buildings in the West for electric light, telephone and other wires, all of which is due to the untiring endeavors of Mr. H. M. Underwood, general Western agent of the Interior Conduit & Insulation Company, of New York, the following data may be submitted: Up to July 10 arrangements have been made whereby an approximate of 22 private and office buildings will use the interior conduit throughout. The distribution being about 58,105 incandescent lights. In addition to this there are fine private residences which vary from 160 to 700 lights each, and two or three installations of concealed wires for about 150 arc lights. Two of the above private residences will have all wires, fire alarm, etc., run through conduits. L. W. C.

Chicago, July 11, 1891.

OUR CINCINNATI LETTER.

The Standard Electric Works, dealers in electrical supplies, have a very heavy trade in Okonite and Candee wires, and the new celebrated commercial lamp cord.

The Queen City Electric Company, of Cincinnati, report an excellent trade. They report among recent sales a number of large isolated plants, sold for export. These plants will be installed in different cities in Mexico. The Queen City Electric Company are contemplating the building of a large central station in Cincinnati this Fall.

Mr. J. C. Hobart, secretary of the Triumph Compound Engine Company, reports a very flattering demand for their engines. Every department of their plant is over-worked and they are at all times unavoidably behind in their deliveries. This company will in all probability make a very great increase in their manufacturing facilities, thereby enabling them to complete and deliver their work without any considerable delay.

The Nowotny Electric Company are introducing something extremely novel in the way of a primary battery. The battery is moulded entirely from a fine quality of carbon—the cup itself being of this material—giving it 196¼ square inches of carbon space below the fluid line. This battery has been subjected to some very severe tests, and has withstood them all. It is best adapted for telephone use. They issue a neat descriptive catalogue.

The Card Electric Motor Company, of Cincinnati, are at the present time very busy turning out their well known type of dynamos and motors. Business has increased so with this enterprising company until it has become necessary for them to look around for larger and more desirable quarters; they will very shortly increase their facilities to at lease double that of the present. Mr. J. E. Hockett, the general manager of this company, is a pusher, and we predict a large and successful trade for the Card Electric people.

The Boughen Engineering Company, contractors for steam and electric plants, have secured the contract for the entire power transmission machinery of the Cincinnati Street Railway Company, also for the Brighton generating station and the Cincinnati Inclined Plane Railway. The machinery of the well-known Hill Clutch Works has been used in this case, as the Boughen Engineering Company are agents for these goods in Cincinnati. They are also completing the steam plant in the St. Nicholas Hotel, in Cincinnati, using two 300 horse-power Root boilers, fitted with the celebrated Murphy smokeless furnace. They are also placing five Murphy smokeless furnaces in the new city hall. L. W. C.

Cincinnati, July 9, 1891.

OUR KANSAS CITY LETTER.

Thos. F. Clohessy is doing a booming trade in Crocker-Wheeler motors for elevator and ventilating service.

Although business in Kansas City is reported quiet in a great many lines this cannot be said of the electrical interests. There are now several fully equipped supply houses here and they all report a very good trade.

Mr. S. M. Stevens, superintendent of the Western Electric Storage Battery Company, this city, is now in Lowell, Mass., investigating the manufacturing of the Bradbury & Stone storage batteries prior to starting a factory in this city with a capacity of ten cells complete from the start.

The Gate City Electric Company are doing an excellent business. The demand for the different brands of Okonite goods handled by this company is unprecedented. Mr. W. H. McKinlock has been recently elected president of the company and Mr. W. D. Greene manager. There is a rumor that the company will secure larger and more desirable quarters.

Mr. J. W. Mason, formerly manager of the Gate City Electric Company, who recently opened a supply house, says that although open but a few weeks he has had a very flattering trade, far ahead of his expectations. Mr. Mason has secured the sole agency of a number of the most desirable specialties in the trade and starts in with brightest prospects. He has a fine, large store located at 527 Delaware street.

A handsome Photo has just been placed in a frame and now adorns the office of the genial M. E. Bates, general manager of the Western Electric Construction Company. The picture is that of the train of 19 cars of selected poles used by this company in the construction of the 18 miles of the Denver and Suburban Electric Railway. This firm have supplied the entire steam plant and track equipment and are doing the construction as well. Edison generators are used.

The Franklin Electric Company, dealers in electrical supplies and contractors for light and power plants, has recently been organized and has secured two entire floors at 535 Delaware street. The first floor front has been fitted up and stocked with a full line of electric supplies; the balance of the space has been filled up with machinery of the most improved make, placing this firm in a position to cater for all branches of repairs and construction. The firm is composed of three gentlemen of wide experience and well known in electrical circles: Mr. W. H. Blood, Jr., Mr. G. E. Claflin and Mr. A. M. Miller. Mr. Blood was for two years foreman of the railway motor and alternating dynamo assembly rooms of the Thomson-Houston Company. Mr. Claflin has been for years with the Westinghouse Company and for the past two years district engineer for this company, with headquarters at St. Louis, Mo. Mr. Miller is a thorough mechanical engineer and has years of experience in installing lighting and power plants. Mr. Miller is thoroughly posted on all branches of electric railway construction. It would seem that the combination is a good one and should be successful. This company has just secured a franchise for one of the cities of Iowa, and will install an arc and incandescent plant, to cost about $20,000. L. W. C.

Kansas City, July 10, 1891.

The New York Electrical Society Meets at Eldorado.

In response to an invitation from the Palisades Amusement Company, and through the courtesy of Mr. W. J. Hammer, the consulting electrical engineer of the company, and Mr. C. R. Dean, the representative of the Thomson-Houston Electric Company, the New York Electrical Society held their regular meeting on Friday evening July 10, at Eldorado, on the Palisades.

After the regular business of the meeting was disposed of, Mr. T. C. Martin moved that a vote of thanks be tendered to Secretary Geo. H. Guy for his faithful and conscientious efforts in behalf of the society. The motion was warmly seconded, and carried unanimously. President F. B. Crocker then addressed the meeting, and moved that a committee be appointed to make arrangements for permanent headquarters for the Society. This was also seconded and a committee of three, consisting of President Crocker, Secretary Guy and Herbert Laws Webb, duly appointed.

The committee on nominations then submitted the following names of officers for the coming year, who were elected:

President, F. B. Crocker; vice-presidents, T. C. Martin, G. H. Stockbridge, E. L. Bradley, Frank J. Sprague, W. J. Hammer, Chas. Steinmetz; secretary, Geo. H. Guy; treasurer, Henry A. Sinclair.

An early adjournment was taken in order to give the members an opportunity of witnessing the "Destruction of Jerusalem," the freedom of the amphitheatre being also extended to them by the company. The performance is undoubtedly the finest thing of the kind ever produced, and was heartily enjoyed by all present. After the display of fireworks, which concluded the entertainment, the society was escorted to the electric light station and shown over the plant, which, considering the short time in which it was put in (20 days), the Thomson-Houston people have reason to be proud of.

The plant consists of three 50 light 1,200 candle-power arc dynamos, and one 650 light incandescent dynamo, all running to their full capacity. They are driven by two 100 horse-power McIntosh & Seymour engines, and all the smaller fittings of the station are of the finest quality. The numerous buildings and spacious grounds, in their brilliant illumination, present a fairy-like scene, and the eye encounters electric lights sparkling among the trees at every turn. All the circuits are interchangeable, the highest grade of insulated wire is used throughout, and in fact every thing possible has been done by the enterprising parties having the work in charge, to make it strictly first class.

The plant as it now stands has cost about $25,000 and further additions are constantly being made, and will continue as long as the requirements demand.

REPEAL THE ELECTROCUTION LAW.

The foolish law of capital punishment by electricity, which proved so ghastly a failure in the roasting of Kemmler, again repeated its experience in the case of the four murderers executed at Sing Sing. The attempt of the legislature to throttle the liberty of the press by ordaining that no particulars of the execution be published, prompted the jail warden, who acted as executioner, to bind the few scientific gentlemen present to secrecy. Few of the details have been learned, but it is tolerably certain that the new mode of killing has nothing to recommend it over hanging. It is plainly and simply, as now five times conducted, a process of slow roasting revolting to any civilized individual. Such must necessarily be its character. The heavy current which is used can in a very brief interval bring the blood to a boiling heat; the testimony of reliable witnesses confirms this statement, as the bodies were *hot* after execution. What does it signify if life has fled; the boiling and roasting process must follow in order to *make sure* that death has come. This highly scientific process of killing is so uncertain in character that whilst a few seconds may suffice for one individual, a considerably longer interval is needed for another. This painful uncertainty is what makes the whole thing so harrowing to observers as well as observed. Another intensely disagreeable feature of the method is the multiplicity of straps and toggery which require adjustment before the judicial sentence can be executed.

When one reflects for a moment, the ghastliness of such a procedure makes him creep, and he wonders how long such a revolting spectacle will be tolerated in a civilized community. The whole business is stupid from beginning to end. An experiment with a gravity battery and a pair of frog legs and the accompanying grotesque contortions is enough to convince the most ignorant that humane killing is not to be looked for in this direction. Again, why an alternating current of high ampereage should be used is beyond conception; it only serves to bring into popular disrepute a highly useful source of energy, whereas, with an induction coil the lightning's flash might be counterfeited and though the poor wretch who expiates his crime be torn limb from limb, it would at least admit of instantaneous operation and dispense with the varied assortment of harness now required. As said in these columns after the Kemmler fiasco, there can be but one result of such proceedings. The electrocution law must be repealed. As an abridgment of liberty of speech and the freedom of the press it is unconstitutional; as a mode of execution it is uncertain; as a punishment it is barbarous. It is likely, when the true inwardness of the proceedings at Sing Sing is known, the people will demand a repeal of the law in a voice too imperative to be ignored.

The dangers of electricity have been discovered in a new place. This time it is in the ice cream freezer. Dr. Geo. S. Hull has conducted some experiments, the result of which he has communicated to the *Medical Record*, with ice cream freezers, and he finds that galvanic action takes place, which results in the introduction of poisonous salts of copper and zinc into the cream. It appears that the freezer and the paddle are generally made of dissimilar metals, and the cream, especially if mixed with fruits or other acid, or even saline substances, forms an electrolyte which naturally completes the necessary conditions for galvanic action. With galvanic action there is, of course, chemical action resulting in the formation of salts of zinc and copper which become mixed with the cream. Dr. Hull has probably discovered the cause of many mysterious cases of poisoning which have followed the consumption of ice cream. The remedy, however, seems to us a very simple one, as if the freezer and the mixer were made both of the same metal, no galvanic action could take place.

Telephone News

*** Baltimore druggists have organized to fight for lower telephone rates.

*** The Southern New England Telephone Company has begun the work of putting its wires underground in Bridgeport, Conn.

*** The Sunset Telephone Company is erecting a new line from Oakland to Haywards, Cal. The poles are 35 to 40 feet high, with iron braces and iron steps. It is the finest line of poles to be found in the State.

*** Mr. John I. Sabin, the well-known California telephone man, is said to be interested in a big family hotel to be built in San Francisco. Electric lights will be used, and not a single gas pipe will be put into the building.

*** The annual meeting of the stockholders of the Tropical American Telephone Company will be held at the company's office, Long Branch, N. J., on Wednesday, July 29, 1891, at 10 A. M., for the election of officers; for action on the question of paying a dividend; for action on the question of acquiring a valuable patent, and the transaction of such other business as may legally come before the meeting.

*** The new system of telephones for the Thomson-Houston factories at Lynn, Mass., is nearly ready for use. There will be between 50 and 75 telephones used, and each deskman will have one, a Blake transmitter being placed on a standard on his desk, and a receiver being placed under it. He will press a button to ring up central, who is in a corridor of the office building, with a 75-drop switchboard. Each telephone will have a private wire, 19,000 feet of twin wire being used.

*** The instrument output of the Bell Telephone Company for the month ending June 20, and for the fiscal year to that date, is reported as follows:

	1891.	1890.	Inc.
Gross	8,211	7,758	453
Returned	2,667	1,927	740
Net	5,544	5,831	*287
Since Dec. 21—	1890-91.	1889-90.	Inc.
Gross	37,924	33,577	4,347
Returned	18,761	12,104	6,657
Net	19,163	21,473	*2,310

*Decrease.

*** One of the old telephone suits was reopened in Boston, June 29, before A. J. Lowe, W. D. Caldwell and Charles M. Allen, commissioners, and was the hearing of the suit of James W. Bennett, Henry L. Tibbetts and others against W. H. Bent, Loren N. Downs, W. A. Ingham, C. J. Glidden and A. A. Coburn, for alleged false representations concerning the value of certain telephone stocks. These suits were brought about six years ago, and since that time up to the present day property of the defendants has been exempt from actual attachment by bonds given.

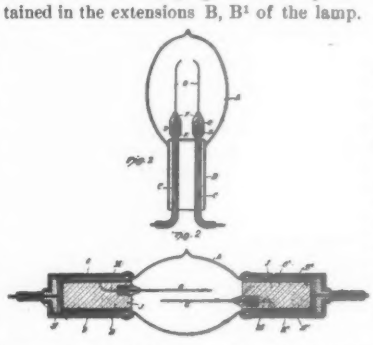
A Large Engine Order.

The Pond Engineering Company has recently received a large order for the well-known Armington & Sims engine, for which they are the general Western agents. This order is from the Chicago Edison Company, and the engines, of 400 horse-power each, will go in the central lighting station on Adams street. The first engines in this plant were made by the Armington & Sims Company, but the management thought best to make a trial of other makes. After careful tests of engines built by two other firms, they have ordered as above. They were anxious to place their entire order for their new equipment with the Pond Engineering Company, but the latter, owing to other large orders, were unable to promise delivery as required. The Edison Company, therefore, gave them orders for as many engines as they could furnish, and were obliged to place the contract for the rest of the equipment elsewhere.

Tesla's Incandescent Lamp.

In the accompanying engravings are illustrated two types of improved lamps invented by Mr. Tesla, and designed for use in his recently patented system of incandescent electric lighting by means of high frequency currents. The lamp shown in Fig. 1 is designed for direct connection with a circuit or source of current; that shown in Fig. 2 is designed for inductive connection with a source of current. In the device illustrated in Fig. 1, A represents a highly vacuous glass globe, in which are sealed conductors, B, C, united with two pieces of carbon G, the joint being surrounded with bronze powder E to effect good connection. The cups surrounding the joint are filled with insulating plugs F of fire-clay. The exhaustion is carried to the highest possible point. Inasmuch as there is a tendency to sparking when the current is turned on before the exhaustion has been carried very high, the ends of the carbon are caused to approach in order that the sparks may leap across between such currents, thus lessening the danger of injury to the carbons. The distance apart of the carbons in the lamp is beyond sparking distance in the vacuum. The system in which this lamp is used, described in a late issue of the REVIEW, consists of disruptively discharging the accumulated energy of a condenser through a primary circuit to produce a current of very high frequency, and then utilizing this primary circuit to induce in a secondary a current of very much higher potential.

In Fig. 2 the carbons are not connected directly to the leading-in circuit, but are inductively connected therewith by a condenser-like arrangement. One form of such a lamp was described in the ELECTRICAL REVIEW. J J are plugs of fire-clay contained in the extensions B, B^1 of the lamp.



The conductors G G are supported by these plugs and connected by metallic strips M with the condenser-coatings K K^1. Over the outside of the stems B B^1 are fitted insulating caps N N^1, having metallic linings O O^1, with terminals adapted for connection with the circuit wires. It will thus be seen that the carbons are out of contact with the supply conductors, and can only be acted upon inductively thereby. The incandescence to which the carbons are raised is supposed to be due to the heat developed by the rapid charge and discharge of the condenser.

LITERARY.

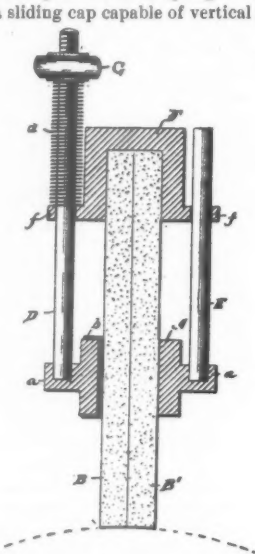
"Bulletin de la Société Internationale des Electriciens," for June, 1891, has been received.

Next month the *Cosmopolitan* promises to print the opening chapters of a short novel by Amelie Rives, which she entitles "According to St. John," and which is said to be the best work from her pen.

The Bridgeport Brass Company, of Bridgeport, Conn., have in press the third edition of their valuable book of tables, and have added several new tables for the use of telephone and telegraph people, one giving the cost of their celebrated hard drawn copper wire per mile, all gauges, and at prices ranging from 14 to 25 cents per pound. These tables are prepared by Mr. Henry D. Stanley, of the Bridgeport Brass Company, and have been found most valuable to all branches of electrical industries. The Bridgeport Brass Company will take pleasure in sending copies of these tables to any one who may send a request to them at Bridgeport, Conn.

Improvement in Carbon Brushes.

In the accompanying engraving is illustrated an improved carbon brush for motors or generators, designed by E. L. Riker, of New York. The brush is composed of duplicate plates of carbon held upon the commutator, indicated in dotted lines, by the elastic pressure of a spring *d* bearing upon a sliding cap capable of vertical move-



ment upon two posts, D, E. The lower part of the carbon is steadied by a guide A, one side of which is cushioned at *b* to prevent the carbons from rattling. As the carbons wear away and the spring relaxes, its tension may be increased by adjustment of the thumb nut G.

Card Electric Dynamo & Motor Company's Fan Outfit.

Our illustration is an excellent representation of the new type, one-sixth horse-power fan outfit manufactured by the Card Company, of Cincinnati. This is a model machine, automatic, has self-oiling bearing of first class design and is almost noiseless, though running at a very high rate of speed. This machine is made with few parts, having, as is shown in the cut only two castings and a wrought-iron field. All parts of the Card motors are interchangeable so that, should an accident occur, it is always possible to replace any part without delay.

OUR ST. LOUIS LETTER.

Again the question of placing all wires underground is being agitated.

The Sale of the electric light companies to the gas company was not carried out as reported.

The St. Louis Electrical Supply Company have placed a very neat electric fan on the market.

The Southern Electric Supply Company are receiving a good business in wire, especially from Southern points.

The Union Depot, Lindell Railway and Missouri Railway, have all ordered a new equipment of motor and trail cars.

The Emerson Electric Company are still busy with orders, and are taxing the capacity of their two factories to the utmost.

The St. Louis & Suburban are rapidly constructing their electric line and expect to have it in operation in a few days. The St. Louis Car Company are building the cars.

A Novelty as much in the electric as in the real estate line, was the idea of a real estate firm here who held an auction of several thousand feet of land by electric light. Several hundred arc and incandescent lights were used to illuminate the grounds, and the selling of property was carried on until 10 o'clock P. M.

Now that Postmaster Harlow has received the necessary authority from Washington, he intends to put in use at once the system of distributing the mails by street car. At the present time it takes the mail wagons a much longer time to reach the sub-stations from the main post office than it does the electric cars. Hence, so soon as the necessary cars are built Mr. Harlow intends to try the experiment, not only of distributing the mails to the sub-offices, but also along the line of the cars. The first mail contract will be let to the Lindell railroad, and should it prove a success on this line, mail cars will be placed on all the electric lines. There is no doubt that rapid transit has not only proved a great success in St. Louis, but promises to out-do in more ways than speed the old "bob-tail" of 1888. W. H. B.

St. Louis, July 7, 1891.

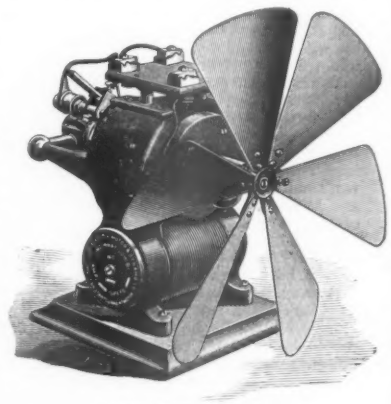
The Blackening of Incandescent Lamps.

LEIGH S. POWELL IN LONDON "ELECTRICAL REVIEW."

The references which have lately appeared in the *Electrical Review* relative to the depreciation in the illuminating power of incandescent lamps through blackening, and its consequent bearing on the economic length of time that lamps should be kept in use, have a peculiar interest to those who have made this department of electric lighting a special study. The tables given show clearly the different degrees of darkening tendency which lamps of different manufacture possess. It is not forgotten that other causes besides blackening contribute to diminish the illuminating power, but in most lamps at least, the one under consideration is the most influential. To the manufacturer of lamps, then, this blackening feature is naturally one of the utmost importance, since in this direction lies one of the principal possibilities for further improvement. Formerly the writer was of opinion that the problem of diminishing this blackening tendency was about on a par with that of attempting to prevent water from boiling when a kettle of it is placed over a fire. But the two cases are scarcely parallel, for it is an undeniable fact that blackening occurs in very different degrees, not only in lamps of different manufacture, but even amongst their own kind. A good deal of the variation, no doubt, occurs through differences in the temperature of the respective filaments, but this cause is certainly not the only one at work. Much of the difference is attributable to the manner in which the carbon filament has been treated during its manufacture, and this fact raises the very interesting enquiry as to what cause the blackening is due, and wherefore there should be these differences in intensity?

To the writer there appear to be two possible explanations to account for the blackening phenomenon: One is the generally accepted view of the vaporization and sublimation on the glass of carbon, pure and simple; the other, that the obscuring substance may possibly not be pure carbon, but a hydrocarbon, or some allied carbon compound.

Probably every lamp manufacturer is familiar with the fact that lamps made with filaments which have been "baked" at a



CARD FAN MOTOR.

comparatively low temperature, blacken very readily, indeed, whilst when made with others which have been raised to a very high temperature, they resist the tendency very much more effectually. Further, that the same results occur in lamps when low or high temperature flashing has been employed. He is also very familiar with the effect of different temperatures on the hardness of the resulting carbon. If, then, the vaporization of pure carbon be the true explanation of the darkening of lamp bulbs, it follows that the difference in degree must arise solely from the circumstance that a comparatively loose condition of the carbon is especially favorable to the formation of carbon vapor. But the production of carbon at a low temperature would also be especially favorable to blackening, if the hydro-carbon view is the correct one. The writer can well remember when attending

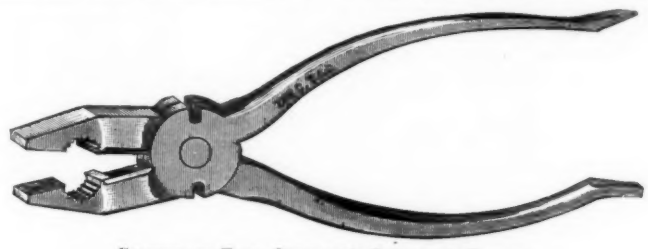
Dr. Frankland's lectures on chemistry, being impressed by that gentleman's assertion that to produce pure carbon by any of the usual methods is almost an impossibility, and that to free it from the ever present combined hydrogen, it is necessary to heat it in chlorine gas for days. That all hydro-carbon compounds are eliminated from the filaments in ordinary use is, therefore, extremely doubtful. In further support of the view that the presence of hydrogen may exert an influence in the feature of blackening, the fact may be cited that filaments of carbon baked at a low temperature become materially harder in process of running lamps made with them, and yet the rate of blackening, instead of diminishing, seems to proceed at an accelerating rate. It would be most interesting if those who have the opportunity would collect and thoroughly examine the composition of the deposit which collects on lamp bulbs, and thus throw valuable light on this interesting subject, and in addition, direct the steps of the pioneering lamp manufacturer into a track which is likely to lead to a material decrease in this unfortunate property of lamps. To carry out the work satisfactorily, it would be necessary to examine the deposit obtained from lamps from various sources, and then, should it prove to be other than pure carbon, to further ascertain, if possible, the treatment the respective filaments have been subjected to. The latter undertaking would, probably, be the more difficult of the two, considering the commercial interests at stake. It may be mentioned that the obscuring film is readily removed from the glass by means of a little warm caustic soda solution. Also the fact that the film is a sufficiently good conductor of electricity, even when faint, to become coated with copper when a piece of the glass is made the cathode in a copper-plating bath. It is possibly due to this fact that an incandescent lamp acts as such an excellent condenser.

It is interesting to speculate as to how the obscuring matter, whatever it may be, finds its way from the filament to the glass. It is conceivable that there may be three methods by which the transfer can be effected: Firstly, by the direct formation of a vapor, as in the case of the vaporization and sublimation of arsenic; secondly, by the solution to saturation of the matter in the residual gas and subsequent precipitation therefrom on the neighboring cold surface, as instanced by the solution of water in warm air and its reappearance on a window or other cool surface; thirdly, by the mechanical emission of solid particles. From a consideration of specimens of blackened lamps, it is difficult to determine which of these methods is the true one, or whether two or more methods combine to effect the transfer, because, in vacuo, the conditions of matter are so materially altered in so many essential details from those with which we are ordinarily familiar that arguing by analogy becomes impossible. But whether the transfer is effected by gaseous or solid particles, we may note certain very significant effects. The sharply defined uninterrupted circular line of slightly tinted glass, so distinctly visible by daylight in every well blackened lamp whose ∩-shaped filament is perfectly symmetrical, tells a peculiarly interesting tale. There can be no doubt that this half-colored line is caused by the limb of the filament nearest the glass acting as a screen to the emissions of the more distant one. In other words, the projected particles of only one of the limbs can strike against the light colored strip, because just there the further one is hidden, whereas, in every other part of the bulb they can, and do, strike from both limbs, and, consequently, at all these other parts the glass is colored to twice the depth of the screened portion. Another notable effect is that of the patchy, unequal blackening which occurs in the bulb of a lamp whose filament develops a bright spot, the glass in the neighborhood of the spot being the darkest part. The same thing happens when the filament is bent so as to stand appreciably out of the center of the bulb. From these observations it is perfectly clear that the matter, whether in the form of vapor or solid, is in the radiant condition, and that there is no turning of corners for it. The particles fly direct from the filament to the glass and there adhere to it and to one another as firmly as do the particles of copper on the cathode of an electroplating arrangement; and further, they appear to follow the same law as light, in its property to decrease in intensity with the distance from the issuing point. It naturally follows from this consideration that for a given size of filament, the larger the bulb the less the amount of blackening, other considerations remaining the same.

As regards the remarkably coherent black film, it may be remarked that if it is built up by the accumulation of countless *solid particles* it would entail that carbon is possessed of far more of the soft, doughy property of lead or wax than one is apt to attribute to it. The principal causes assisting to bring about the cohesion, assuming this view to be correct, are, no doubt, the probable enormous velocity with which the particles travel, and the freedom from any foreign matter acting to interfere with the intimate contact of such particles as they collect.

The Cincinnati Tool Company's Combination Lineman's Pliers.

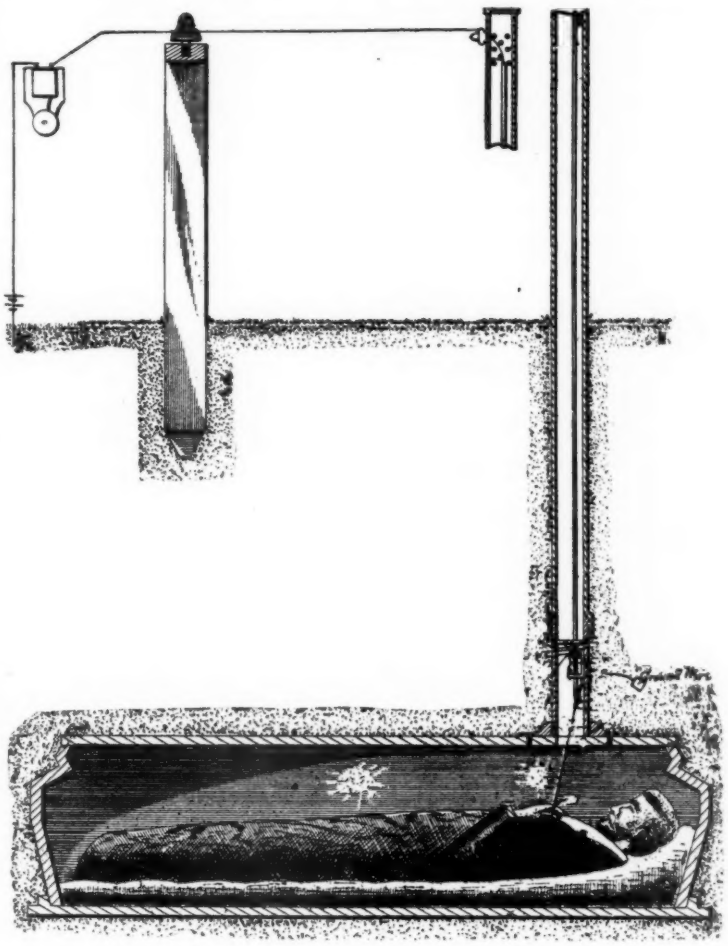
Our illustration shows a comparatively new and useful article. This little tool is made of the very best tempered steel, highly polished. It is all that its name implies. The nose of the pliers is perfectly flat, combining gas plier and wire cutter, and side cutters, cutting perfectly square and flush with any flat surface; this is an especial feature. The handles are finished, one a little longer than the other, the long one being a good screw-driver, the other a reamer. The pliers are well made, and are manufactured by the Cincinnati Tool Company, Cincinnati, Ohio.



CINCINNATI TOOL COMPANY'S LINEMAN'S PLIERS.

Telegraphy from the Grave.

There are thousands of people who are in mortal dread of being buried alive and of recovering the use of the bodily functions while entombed under six feet of superincumbent clay. To all such a grave-announciator, recently patented, and which is illustrated herewith, will be full of comforting assurance. Indeed, in this contrivance, a resuscitated cadaver can announce the good news telegraphically with as great ease as a Western Union operator can chuckle over the wires. Communicating with the casket is a pipe in which is placed a valve to prevent the gases of decomposition from escaping. In this tube is a circuit-closer connected with a cord, which is attached to a ring placed upon the finger of the "late lamented." A wire carried through the tube and extending to an electric bell located at any suitable point, which may be in a watch-house, or in the dining-room or bed-chamber of the anxiously awaiting friends, establishes the necessary electric communication.



TELEGRAPHY FROM THE GRAVE.

Referring to the economic length of run that a lamp should have, it seems to the writer that any particular number of hours arrived at by calculation, can only hold good in a general sense, for the reason that lamps *do not* all blacken equally in the same time. Probably the actual run that lamps will have, in private houses at any rate, will be determined by the inconvenience experienced from an insufficiency of light, rather than by any other consideration.

TELEGRAPHIC

.... A telegraph line is being put up between Chester and Grafton, Vt.

.... The poles of the Postal Telegraph Company, at New Orleans, have been cut down by order of the city officials, who claim that the company did not obey orders to put the wires on a high pole system prescribed by a city ordinance.

.... The Commercial Union Telegraph Company has recently opened at Burnham, Clinton and Pittsfield, Me. It is pushing the construction of a line from Great Falls, N. H., to Rochester, N. H. At Bar Harbor the Commercial Union has several finely appointed offices.

.... The work of transferring the main office of the Western Union Telegraph Company from Broad street and South Penn square to its new quarters, at Tenth and Chestnut streets, Philadelphia, was accomplished July 4, and so successfully that there was no delay occasioned, and the work of the office was not interfered with.

.... The Electric Club, N.Y., has received from the Edison General Electric Company a number of their new and breezy fan motors. A patient and perspiring man remarked:

A cooling breeze,
A ditto drink;
By aid of these
A man may think,
"How hot it is!
How cool I am!
Let business go—
Don't give 'er d—!"

.... At a meeting of the stockholders of the American District Telegraph Company, of Superior, Wis., the following board of directors were elected: Charles L. Catlin, Myron Reed, W. C. Brooks, John T. Murphy and H. C. Hope. At a subsequent meeting held by the directors, H. C. Hope was elected president and H. S. Butler, secretary and treasurer. W. R. Hope has been secured to fill the position of manager.

The State of Massachusetts vs. the Western Union.

The Western Union Telegraph Company is made a defendant to a suit brought by the attorney-general of Massachusetts on information of the treasurer of the Commonwealth. It is a suit in equity to recover taxes for the year 1890 alleged to be due the Commonwealth, amounting to $17,713.84. The case is returnable to the Supreme Court in September. The tax is levied upon the corporate valuation of the company throughout the whole Union, based, however, upon the mileage line of the company in the State. The total corporate valuation of the company in the United States is placed at $73,139,970.31. The amount of capital confined within the State limits is $1,193,634, reckoned on 2,966.71 miles of line. It is upon this latter basis the tax is determined. Other suits have previously been brought against the company for this tax.

Electric Lighting of St. John, N. B.

St. John is now probably one of the most brilliantly lighted cities in the Dominion (owing in a large measure to the interest created in electrical work by the electric exhibition recently held in that city), there being five of the finest central stations of electric light companies in the city, running the Edison, Thomson-Houston, Fort Wayne and Brush electric light systems. The competition between these companies brings the light within the reach of the citizens generally, and very many of the property holders have, therefore, indulged very lavishly in electric light. In addition to this, the corporation of the city is now running electric lights of their own in the North End, Brush plant, and Messrs. D. W. Clark & Son are running the Brush system at the West End, and the New Brunswick Electric Light Co. (Fort Wayne system) have completed their arrangements for lighting the East End, and are giving splendid satisfaction.

* * A street railway car is being fitted up with the Barrett storage batteries for trial at Hartford, Conn.

* * The Appleton, Wis., council passed an ordinance July 2, abrogating the franchise of the electric street railway.

* * The trolley poles are being set along the line of the North Baltimore, Md., electric railway, and soon that portion of the city will be within 10 instead of 30 minutes of the City Hall.

* * An electric railway is to be built to connect Charleston and Kanawha City, W. Va., the new town laid out about a mile and a half from Charleston on the opposite side of the river.

* * Mr. George W. Morse, of Boston, is reported to have bought the Americus, Ga., electric street railway at a receiver's sale for $35,000. There is some talk of moving the road to Macon, Ga.

* * The Westchester, N. Y., Electric Railroad Company proposes to build an electric surface railway through the town of Pelham to the entrance of the New York Athletic Club grounds, and connecting with the New York, New Haven and Hartford Railroad.

* * The Seashore Electric Railway Company, of Asbury Park, N. J., have received the insurance on their plant, which was recently destroyed by fire. They got $15,090, which was $160 less than the policies called for, it being determined that the old dynamos were worth the $160 deducted.

* * A grant has been made and the construction begun of an electric conduit line upon Fullerton avenue, Chicago. The conduit in the Love system, which is the style of equipment used in Chicago, is but 15 inches in depth, and the slot rails are easily detachable to allow of cleaning.

* * *The Boston News Bureau* gives the earnings of the Minneapolis Street Railway Company since January 1, as follows:

Month.	1891.	1890.	Inc.
January	$70,873	$45,625	$25,248
February	62,000	41,767	20,233
March	70,568	48,910	21,658
April	77,499	49,499	28,000
May	85,061	52,740	32,021
June	*59,435	56,421	3,014
Total	$425,436	$294,872	$130,564

*3 weeks of June, 1891.

* * The Essex, Mass., Electric Street Railway Company, running a single line from Peabody to Salem Willows, carried 5,593 passengers on the Fourth of July. The Naumkeag Street Railway Company carried on all its divisions on the same day 42,324 passengers. This number has only been exceeded once, and that was on a camp meeting Sunday some years ago, when the total patronage reached 48,000.

* * A meeting was held at Sutter Creek, Cal., July 1, with a view to organizing, incorporating and asking the board of supervisors to grant a franchise for an electric railroad from the Ione terminus of the Southern Pacific to Sutter Creek, a distance of 12 miles, with branches to Plymouth and Jackson. One hundred thousand dollars of stock was subscribed, and 10 per cent. paid down. The necessary preliminaries and survey have commenced.

* * President Thurston, of the Jersey City & Bergen Railroad Company, is authority for the statement that his company and the Rapid Transit Company, of Newark, N. J., have been in conference with a view to establishing an electric road between Jersey City and Newark. He holds out hope of the scheme coming to fruition. If it is built, the road will be one of the longest electric lines in the country, and a capital of $25,000,000 will be engaged. The line, when it is established, will utilize the line of the Rapid Transit Company, in Newark, and Mr. Thurston's lines in Jersey City.

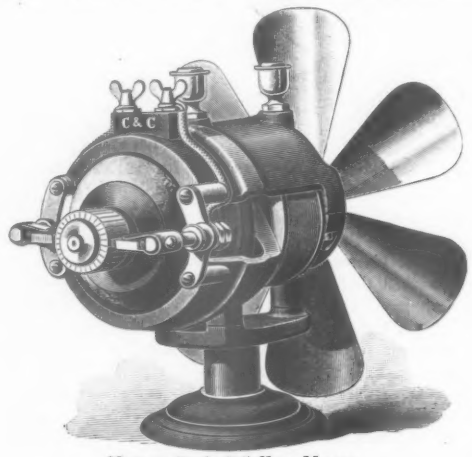
500-Volt Fan Motor.

Street railway and other power circuits of a pressure of 500 volts are constantly growing in number, and this has recently led to a demand for small motors and fan outfits adapted to this voltage. The problem of designing a one-eighth or one-quarter horse-power motor for so high a voltage has many factors that do not occur in building larger machines, while some of the main objects to be attained in large machines assume a very different aspect in these pigmies.

For example, in the matter of economy of copper these small motors cannot be laid out for the least weight as in larger ones, owing to the great increase in cost of the smaller sizes of wire so that the least cost may be far from the least weight.

Again, one is limited by the mechanical strength of the wire, as the finer sizes are apt to be drawn out or broken in the rapid handling necessary in manufacturing on a large scale.

Another difficulty in designing is the limitation in size, especially in fan outfits, which must be small enough to move from place to place, while at the same time the area of the pole-pieces must be large enough to reduce the armature turns to a reasonable number.



New "C. & C." Fan Motor.

Finally, the cost of construction must be reduced to rock bottom, as the wire alone on a high volt machine may cost as much as a whole motor of low voltage.

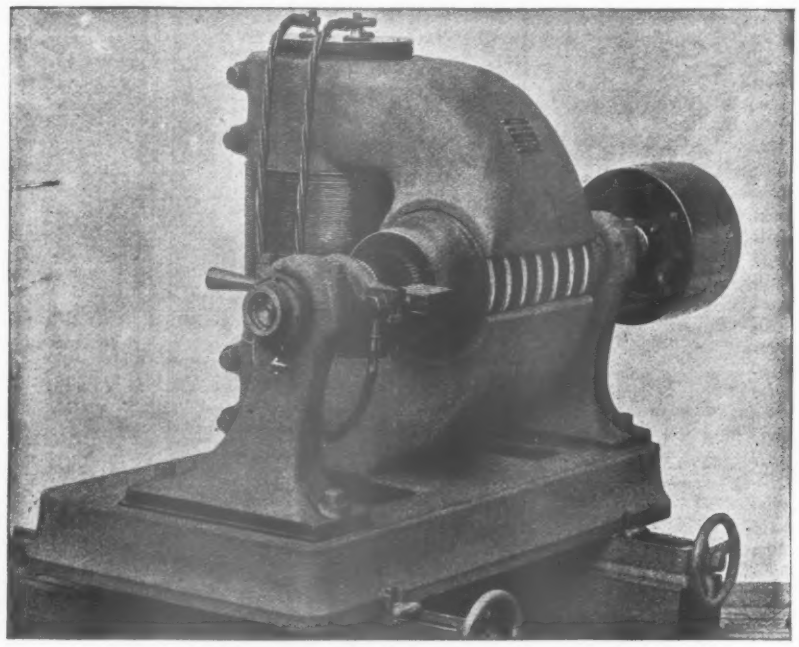
With these points in view the motor herewith illustrated has been designed by Mr. F. V. Henshaw, of the "C. & C." Electric Motor Company. The field-magnet is semi-ironclad, being formed of two castings joined at one end and held by a single bolt, while the opposite projecting ends form the poles. The lower casting has a cylindrical core, over which the single field coil is slipped. This core is cast hollow, and the shaft passes through it, having bearings at each end. As will be seen, this arrangement allows a relatively large diameter of armature without increasing the size of the machine greatly. The armature is of the ring type, supported on the shaft by three arms. The whole front of the armature is covered by a rubber disk against which the commutator is fastened. This disk serves to keep the frail connecting wires in place and also as a protection to the armature. The brush holders carry two or more round carbons of standard size, which can be replaced by simply turning the holder around, putting in new pieces and turning back. Both field and armature coils are wound separately on a lathe. With duplicate sets of armatures and field bobbins of the proper winding, it is but the work of a few minutes to change these machines from one voltage to another, which is sometimes convenient.

The one-eighth horse-power motors are finished with bearings requiring very little oil, while the larger motors have self-oiling bearings.

The "C. & C." Electric Motor Company are turning out large numbers of these machines, the demand for which is constantly increasing.

Queen & Company's Tachometers.

Queen & Company, Philadelphia, are just now making a specialty of tachometers for indicating the speed of engines, dynamos and motors. These instruments are quite as essential to the economical operation of a plant as ammeters and voltmeters, which fact is being demonstrated by the greatly increasing demand for them. By means of a tachometer it is possible to tell at a glance the exact rate of speed at which an engine or dynamo is running. For portable work a special instrument is made which takes up but little space and can easily be carried about. This tachometer is as accurate in its readings as the larger type mounted on a strong base and designed for permanent attachment in the engine or dynamo room.



Jenney Motor Dynamo.

Jenney Dynamo, Motor and Power Generator.

We illustrate this week the type used by the Jenney Electric Motor Company, Indianapolis, Ind., in their constant potential dynamos, also for their larger motors and power generators. The aim has been to produce a magnetic field of great strength which will be at the same time economical to maintain. By studying the direction of the magnetic lines of force about a straight bar magnet, the inventor was led to design the form of magnet shown. The natural direction and curvature of the lines of force as they pass through the air from one pole to the other in a bar magnet, are well known. In this machine the pole pieces were made to correspond with the natural curvature of the lines of force, thereby reducing to a minimum the length of the magnetic circuit and its resistance.

There is but a single field magnet, and in all sizes the core is made of the softest wrought-iron. No yokes are needed. There are no projecting ends or corners on the pole pieces, with their attendant loss of magnetism. The cores extend entirely through the pole pieces, which are bored to fit them accurately. The pole pieces are slotted, and by means of bolts are firmly clamped to the core. By this means the largest possible surface contact is secured, and a most perfect magnetic union with an extremely small amount of magnetic resistance. By this construction are secured results not possible to dynamos or motors having pole piece and cores brought together on planed surfaces.

To this in part may be attributed the superior excellence and efficiency of their dynamos and motor.

The winding of the armature is a modification of the Siemen's method. The electrical resistance is very low, and there are very few turns to the section. The core is built up of thin sheet iron disks securely fastened to a shaft of the best grade of machinery steel, of greatest diameter in its central part.

Self-oiling boxes of improved form are fitted on all their machines. The center of gravity of the machine is low, and all parts are easily accessible for inspection

All motors and power generators are fitted with carbon brushes of the latest and most improved form.

The proportioning of the parts and the winding is such as to be perfectly automatic in regulation. Brushes once properly set, there is no sparking at the commutator, even under severe changes of load.

They are also manufacturing a line of dynamos for electroplating, electrotyping and copper refining.

The full details of their motors, dynamos and power generators are given in a catalogue just issued.

PERSONAL.

George Westinghouse, Jr., stopped at the Windsor Hotel for a few days last week.

Mr. George F. Meyers, fellow in electrical engineering at Cornell University, called at the Review office last week.

H. E. Webb, representing the Solar Carbon & Manufacturing Company, Pittsburgh, called at the Review office last week.

George P. Barton and Charles A. Brown formed the law partnership of Barton & Brown, July 1. The offices of the new firm, success attend it, are in the Temple Court Building, 225 Dearborn street, Chicago.

Mr. James Kempster, the electrical printer, is becoming famous as a fisherman. On Saturday last he caught 137 fine large bluefish in the Great South Bay, opposite the Olympic Club, of which club he is a shining and popular light.

Mr. Jarvis B. Edson, widely known in connection with his recording gauge, is just now, with his family, enjoying his beautiful cottage at Shelter Island. Mr. Edson owns one of the best arranged and most comfortable homes on the Island, admirably located for an agreeable Summer sojourn.

Electric Resonance.

At a meeting of the British Physical Society, held June 12 last, Dr. Lodge showed "Some Experiments with Leyden Jars." The first one was with resonant jars, in which the discharge of one jar precipitated the overflow of another when the lengths of the jar circuits were properly adjusted or tuned. The latter jar was entirely disconnected from the former, and was influenced merely by electromagnetic waves emanating from the discharging circuit. Lengthening and shortening either circuit prevented the overflow. Correct tuning was, Dr. Lodge said, of great importance in these experiments, for a dozen or more oscillations occured before the discharge ceased. The effect could be shown over considerable distances. In connection with this subject Mr. Blakesley had called his attention to an observation made by Priestly many years ago, who noticed that when several jars were being charged from the same prime conductor, if one of them discharged the others would sometimes also discharge, although they were not fully charged. This he, Dr. Lodge, thought might be due to the same kind of influence which he had just shown to exist. The word *resonance* he said, was often misunderstood by supposing it always had referred to sound, and as substitutes he thought that *symphoning* or *symphonic* might be allowable.

The next experiment was to show that wires might be tuned to respond to the oscillation of a jar discharge just as a string could be tuned to respond to a tuning fork. A thin stretched wire was connected to the knob of a jar and another parallel one to its outer coating, and by varying the length of an independent discharging circuit, a glow was caused to appear along the remote halves of the stretched wires. At each discharge each of the wires thus acted like a stopped organ pipe, the remote ends being the nodes at which the variations of pressure are greatest. By using long wires he had observed a glow on portions of them with the intermediate parts dark; this corresponded with the first harmonic, and by measuring the distance between two nodes he had determined the wave length of the oscillations. The length so found did not agree very closely with the calculated length, and the discrepancy, he thought, due to the specific inductive capacity of the glass, not being the same for such rapidly alternating pressures as for steady ones. He also showed that the electric pulses passing along a wire could be caused (by tuning) to react on the jar to which it was connected and cause it to overflow, even when the distance from the outside to the inside coating was about eight inches. During this experiment be pointed out that the noise of the spark was greatly reduced by increasing the length of the discharging circuit. The same fact was also illustrated by causing two jars to discharge into each other, spark gaps being put both between the inner and outer coatings so as to obtain "A" sparks and "B" sparks. By putting on a long "alternative path" as a shunt to the B spark gap and increasing that gap, the noise of the A spark was greatly reduced. He had reason to believe that the B spark was a quarter phase behind the A spark, but the experimental proof had not been completed.

He next described some experiments on the screening of electromagnetic radiation, in which a Hertz resonator was surrounded by different materials. He had found no trace of opacity in insulators, but the thinnest film of metal procurable completely screened the resonator. Cardboard rubbed with plumbago also acted like a nearly perfect screen. In connection with resonators, he exhibited what he called a *graduated electric eye, or an electric harp*, made by his assistant, Mr. Robinson, in which strips of tin foil, of different lengths, are attached to a glass plate, and have spark gaps at each end which separate them from other pieces of foil. One or other of the strips would respond according to the frequency of the electromagnetic radiation falling upon it.

Mr. Blakesley asked whether the tuning of the resonant jars needed readjustment when the distance between their circuits was varied, for, according to theory, the mutual induction should diminish the self-induction of the primary and cause its oscillations to be more rapid. If this was true the method might be used for getting more rapid oscillations. He also enquired whether the glow would appear in the same position on the two stretched wires if their ends were joined.

Dr. Sumpner wished to know how the resistance, inductances and capacities of the circuits and jars were determined, and whether any evidence of irregular distribution of the charges on the tin-foil had been noted. With reference to the overflowing of a jar caused by using a certain length of discharging circuit, he asked whether the overflow did not prove the existence of a higher potential than that which originally existed between the coatings of the jar, and if so, where did the excess energy come from?

Dr. Thompson asked if it would be possible to make a wire circuit analogous to an open organ pipe by putting sheets of metal on the ends of the wires.

Dr. Lodge, in reply, said Mr. Blakesley's suggestion was an important one; but he had not observed that any change in the adjustment was necessitated by varying the distance between the resonating circuits. Neither had he noticed any glow on wires joined to form a single loop; but this might be possible if the wires were long enough to give harmonies. In answer to Dr. Sumpner he said that the capacities were difficult to determine, for with such rapid oscillations the coatings were virtually enlarged. Lord Rayleigh had shown how to calculate the inductances; and the resistances he had practically measured by his alternative path experiments. The overflow of jars, he thought, was caused by the charges in some way concentrating on the edges of the foil, thus causing a kind of flood tide at which the overflow occurred.

The president asked Dr. Lodge what his views were as to the cause of the opacity of ebonite to light. Was it due to a selective absorption which cut off only the rays to which the eye was sensitive, or was the ordinary explanation that it contained impurities which were conducting, and hence acted as screens, likely to be correct? Another possible explanation was that the motion of the ether particles may be in three dimensions, and light be due to the projection of this motion on a plane perpendicular to the ray, whilst electromagnetic induction might be due to the other component.

Dr. Lodge said he believed that ebonite was not opaque, because of conducting particles being present, and was inclined to think that it acted more like ground glass, in which the opacity was due to internal reflections. Such a substance would only be opaque to vibrations whose wave lengths were comparable with the size of the particles.

Westinghouse Lightning Arrester.

Since the Wurts-Winsor lightning arrester was brought out by the Westinghouse Electric and Manufacturing Company, the demand for these appliances has greatly increased, and to-day lightning arresters are considered to be an essential feature in all electric light and power stations. Mr. Wurts has lately made many improvements in the construction of this apparatus, and while it was unnecessary to modify the principle embodied in the very first one, the changes made add much to its simplicity. The accompanying illustrations represent the new style of the arrester for incandescent circuits.

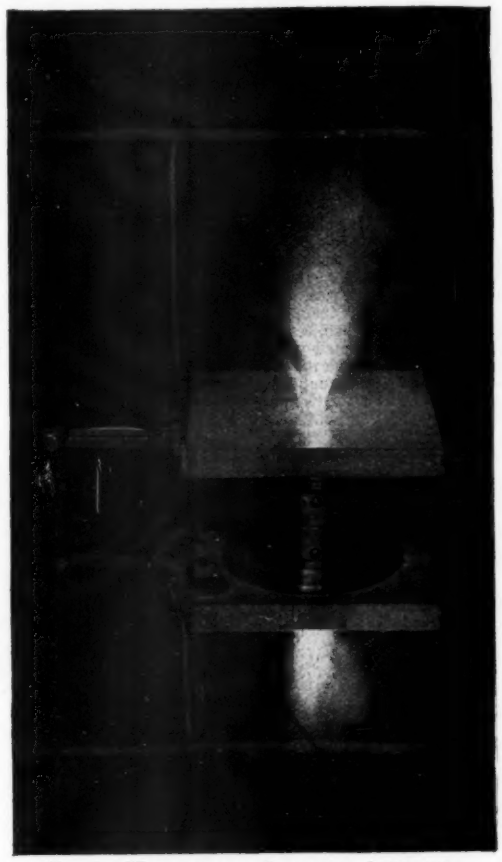


FIG. 2.—WESTINGHOUSE LIGHTNING ARRESTER.

Its distinctive features are that it is made of incombustible material, operates without any electromagnetic device, and its arc is self-destructive. Fig. 1 represents the lightning arrester in its normal position ready for a discharge. The apparatus is compact, consisting of very few parts. It has a cylindrical air chamber of brass, each end of which is covered with a marble plate. Two discharge points on opposite sides of the air chamber, consisting of brass tubes tipped with carbon, are attached to brass lever arms in such a manner as to swing freely through circular openings in the marble plates. Within the air chamber is a carbon ball held stationary in the center, and the two discharge points approach this ball to within one-sixteenth of an inch. The carbon ball is grounded and the lever arms connected to the respective poles of the generator. The operation of a discharge is as simple as it is effective. Supposing a lightning discharge to come in from the line, the discharge will take place from the two discharge points to the carbon ball and from thence to the ground, forming a double arc in the air chamber. The dynamo current will then follow, causing a short circuit on the generator, and the heat produced by these arcs will expand the air in the chamber and drive the two discharge points out, thus extinguishing the arcs and rupturing the short circuit. The next moment the discharge points swing back to their former position within the chamber, and the apparatus is at once ready for another discharge. The entire operation is automatic, and when the lightning arrester is once placed in position it requires no further attention. Fig. 2 is taken from a photograph and represents the arrester in actual operation.

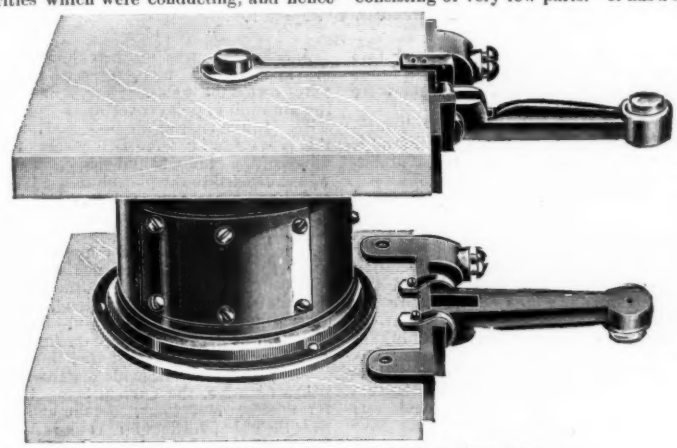


FIG. 1.—WESTINGHOUSE LIGHTNING ARRESTER.

In testing one of these arresters, the binding posts were connected to the poles of a 1,000 volt, 1,500 light alternator, and the two air spaces were bridged over with a small strip of tin-foil. Then by the throw of a switch the generator was short-circuited through the arrester, the tin-foil was fused, the air expanded, the discharge points were forced out of the air chamber against the bumpers, the arcs were blown out with a report like a pistol shot, and the discharge points returned to their normal positions ready for a fresh discharge, all in an inconceivably short space of time. After several hundred such discharges the arrester showed no deterioration whatever.

The Westinghouse Electric and Manufacturing Company also makes lightning arresters on the same principle, but differing in construction, for power house installations and car equipments of electric street railway companies.

ELECTRIC LIGHT NEWS

—— The Corpus Christi, Texas, Electric Light Company has increased its capital stock from $10,000 to $20,000.

—— Yankton, Dak., is considering the feasibility of running her electric light plant by water power from artesian wells.

—— W. P. Campbell is reported as having purchased the electric light plant of the Florence, Ala, Gas, Electric Light & Power Company for about $8,000.

—— The Quincy, Mass., electric light company has declared a dividend of six per cent., payable August 1. It was voted to sell treasury stock at par to Quincy citizens.

—— Receiver Cassin, of the Troy, N. Y., Electric Light Company, on July 2, sold to A. N. Brady, of Albany, the plant of that company for $90,000. Mr. Brady is a shareholder and director of the Troy Gas Company.

—— The engine house of the electric light station at Narragansett Pier, R. I., was destroyed by fire July 5, and the dynamo room flooded with water. Damage about $30,000. Fully insured. The fire was caused by sparks from a locomotive.

—— The use of the electric headlight is increasing in the West, and engines are now equipped with it on the Indianapolis, Decatur & Western; Vandalia; Cincinnati, Hamilton & Dayton; Columbus, Hocking Valley & Toledo; Louisville, New Albany & Chicago; Chicago & Eastern Illinois; Milwaukee, Lake Shore & Western and the Wabash roads.

—— The electric light plant at Bay City, Mich., is being thoroughly rebuilt, and in a few days all traces of the fire will have been removed. A new brick wall is being built between engine and dynamo rooms, and the charred timbers are being replaced with new ones. New machinery is being put in and the old, which was not wholly destroyed, is being repaired.

Electrical Evaporation.

A PAPER READ BY PROF. WM. CROOKES BEFORE THE ROYAL SOCIETY, JUNE 11, 1891.

It is well known that when a vacuum tube is furnished with internal platinum electrodes, the adjacent glass, especially near the negative pole, speedily becomes blackened, owing to the deposition of metallic platinum. The passage of the induction current greatly stimulates the motion of the residual gaseous molecules; those condensed upon and in the immediate neighborhood of the negative pole are shot away at an immense speed in almost straight lines, the speed varying with the degree of exhaustion and with the intensity of the induced current. Platinum being used for the negative pole, not only are the gaseous molecules shot away from the electrode, but the passage of the current so affects the normal molecular motions of the metal as to remove some of the molecules from the sphere of attraction of the mass, causing them to fly off with the stream of gaseous molecules proceeding from the negative pole, and to adhere to any object near it. This property was, I believe, first pointed out by Dr. Wright, of Yale College, and some interesting experiments are described by him in *The American Journal of Science and Arts.** The process has been much used for the production of small mirrors for physical apparatus.

This electrical volatilization or evaporation is very similar to ordinary evaporation by the agency of heat. Cohesion in solids varies according to physical and chemical constitution; thus every kind of solid matter requires to be raised to a certain temperature before the molecules lose their fixity of position and are rendered liquid, a result which is reached at widely different temperatures. If we consider a liquid at atmospheric pressure—say, for instance, a basin of water in an open room—at molecular distances, the boundary surface between the liquid and the superincumbent gas will not be a plane, but turbulent like a stormy ocean. The molecules at the surface of the liquid dart to and fro, rebound from their neighbors, and fly off in every direction. Their initial velocity may be either accelerated or retarded, according to the direction of impact. The result of a collision may drive a molecule in such a direction that it remains part and parcel of the liquid; on the other hand, it may be sent upwards without any diminution of speed, and it will then be carried beyond the range of attraction of neighboring molecules and fly off into and mingle with the superincumbent gas. If a molecule of the liquid has been driven at an angle with a velocity not sufficient to carry it beyond the range of the molecular attraction of the liquid, it may still escape, since, in its excursion upwards, a gaseous molecule may strike it in the right direction, and its temporary visit may be converted into permanent residence.

The intrinsic velocity of the molecules is intensified by heat and diminished by cold. If, therefore, we raise the temperature of the water without materially increasing that of the surrounding air, the excursions of the molecules of the liquid are rendered longer and the force of impact greater, and thus the escape of molecules into the upper region of gas is increased, and we say that evaporation is augmented. If the initial velocities of the liquid molecules can be increased by any other means than by raising the temperature, so that their escape into the gas is rendered more rapid, the result may be called "evaporation" just as well as if heat had been applied. The same reasoning applies equally to a solid body. But whilst a solid body like platinum requires an intense heat to enable its upper stratum of molecules to pass beyond the sphere of attraction of the neighboring molecules, experiment shows that a very moderate amount of negative electrification superadds sufficient energy to enable the upper stratum of metallic molecules to fly beyond the attractive power of the rest of the metal. If a gaseous medium exists above the liquid or solid, it prevents to some degree the molecules from flying off. Thus both ordinary and electrical evaporation are more rapid in a vacuum than at the ordinary atmospheric pressure.

Evaporation of Water.—A delicate balance was taken, and two very shallow porcelain dishes were filled with acidulated water and balanced on the pans. Dipping into each dish—touching the liquid, but not the dish—was a platinum wire, one connected with the induction coil and the other insulated. The balance was left free to move, but was not swinging, the pointer resting at the center of the scale. The water in connection with the coil was first made positive. After 1¾ hours there was scarcely any difference between the weight of the insulated water and that which had been exposed to the positive current. Equilibrium being restored, the current was reversed, the negative current being kept on the dish for two hours. At the end of this time the electrified water was decidedly lighter. After having again restored equilibrium, the electrification of the dishes was reversed, *i. e.*, the one that had before been insulated was made negative and the other one was insulated. In an hour the electrified water had become decidedly lighter than the insulated water. The experiment was performed in a room of uniform temperature, and any draught was prevented by the glass case of the balance. In a subsequent experiment, in which the quantities were weighed, it was found that negatively electrified water lost in 1½ hours one one-thousandth part of its weight more than did insulated water.

This experiment shows that the disturbing influence which assists evaporation is peculiar to the negative pole even at atmospheric pressures.

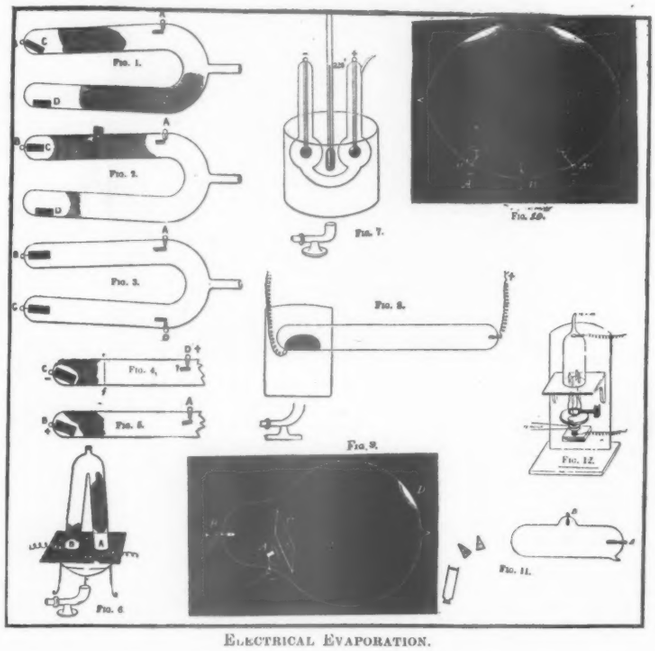
The metal cadmium was next experimented upon.

Evaporation of Cadmium.—If the flying off of the metal of the negative pole is similar to evaporation or volatilization, the operation should be accelerated by heat. A tube was made as shown in Fig. 1. A and B are the platinum poles sealed through the glass. C and D are two blocks of metallic cadmium of the same size and weight. The piece C is in contact with the pole B, which in the experiment was always kept negative, the pole A being positive. When the exhaustion was such that the passage of the current gave green phosphorescence over the glass, heat was applied simultaneously to both ends of the U-shaped tube by means of a gas burner and air-bath, so that one piece of cadmium was at the same temperature as the other. The current was then applied and was kept on for about an hour, and it was remarkable that no metal was deposited in the neighborhood of the positive pole, the surrounding portion of the tube being quite clean, while the corresponding part of the other limb of the tube, having no electrodes, was thickly coated, the appearance being shown in the drawing.

As the temperature was high, metal had distilled off from both lumps; hence, there was no visible difference in the amount of the deposit in the two sides. It is evident that to render the electrical action most visible, the temperature should be kept short of the normal volatilizing point.

In the next experiment an exactly similar tube was used; the vacuum was such that the geeen phosphorescence of the glass was well seen, the temperature was kept just below the melting point of cadmium, and the current was kept on for an hour. On examining the tube at the end of this time, the appearance was as seen in Fig. 2. A considerable deposit had taken place on the end of the tube near the negative pole; the space round the positive pole was clear, while in the limb of the tube where no electricity had been passing, only a very little deposit of metal was seen, as shown in the figure.

The temperature in this experiment having been kept below the melting point, had no electricity been applied, there would have been very little, if any, evaporation. The amplitude of the molecular oscillations was increased by the rise of temperature, but not sufficiently to allow many of the molecules to pass beyond the sphere of attraction of the mass. When, however, the current was turned on, the oscillations were increased sufficiently to carry some of the molecules beyond their spheres of attraction and hence into the vacuous space above. As in the water experiment, this only happens at the negative pole. It would seem that, even after having been *removed* from the rest of the mass, the on-rushing stream of gaseous molecules is necessary to carry the metallic molecules away, and, as I shall presently show, even then they very quickly drop out of the ranks and deposit on the walls of the tube.



ELECTRICAL EVAPORATION.

Another tube was made as shown in Fig. 3. The poles A, B, C, D, were platinum wires sealed through the glass, A and D having aluminium poles covering the platinum wire. In the ends of the tube, and touching the poles B and C, were two pieces of cadmium of the same size and shape. The tube was exhausted to the phosphorescent point, and the current was turned on, C being made negative and D positive. No heat was applied. The current was kept on for about half an hour, until a good deposit of metal had been deposited on the glass, the appearance being as shown in Fig. 4, the glass near the pole C being coated with metal, while the glass round the pole D was clean. The outer boundary of the dark space during the experiment is shown by the dotted line *e f*.

The pole B was now made positive and the pole A negative, the current being kept on for another half hour. At the end of the time the only additional effect was a slight darkening round the lump of cadmium, in the same place as, but very much fainter than, the deposit shown in Fig. 5. This is probably due to a little leakage of negative discharge from the positive pole. The experiment shows that positive electrification does not cause the metal sensibly to volatilize.

In these experiments no estimation was made of the weight of metal removed, and the cadmium only rested by its own weight upon the platinum wires that had been sealed through the glass. To render the experiment quantitative, and at the same time to remove any disturbing effect that might be caused by heating at the point of indifferent contact, the following experiments were made:

A U-shaped tube, shown in Fig. 6, had a platinum pole sealed in each end. Six grains of pure cadmium were put into each limb and fused round the platinum wire. The ends of the tube were then put into an air-bath, and kept at a temperature of 200° C during the continuance of the experiment.* The exhaustion remained at 0.00076 mm., or 1 M. The induction current was kept going for 35 minutes, the pole A being negative and B positive. At the end of this time it was seen that most of the cadmium had disappeared from the negative pole, leaving the platinum wire clean, no metal being deposited near it, and the molecules appearing to have been shot off to a distance of about three quarters of an inch. The appearance of the positive pole was very different; scarcely any of the cadmium had been volatilized, and the condensed metal came almost close to the pole. The tube was opened, and the remaining wires and metal were weighed. The cadmium was then dissolved off the poles in dilute acid; the residue was washed, dried, and weighed.

	Pos. pole.	Neg. pole.
Original weight of cadmium	6.00 grs.	6.00 grs.
Cadmium remaining on pole	3.65 "	0.25 "
Cad. volatilized in 35 mins.	2.35 "	5.75 "

The difference between the amount of cadmium driven from the two poles having proved to be so decided, another experiment was tried in a tube so arranged that the metal could be more easily weighed before and after the experiment. The apparatus is shown in Fig. 7. A tube was blown U-shaped, having a bulb in each limb. The platinum poles were, as before, at the extremities of each limb, and in each bulb was suspended from a small platinum hook a small lump of cadmium, the metal having been cast onto the wire. The wires were each weighed with and without the cadmium. The tube was exhausted, and the lower half of the tube was enclosed in a metal pot containing paraffine wax, the temperature being kept at 230° C. during the continuance of the experiment. A deposit around the negative pole took place almost immediately, and in five minutes the bulb surrounding it was opaque with deposited metal. The positive pole with its surrounding luminosity could be easily seen the whole time. In 30 minutes the experiment was stopped, and after all was cold the tube was opened and the wires weighed again. The results were as follows:

	Positive pole.	Negative pole.
Original weight of cadmium	9.34 grs.	9.38 grs.
Weight after experiment	9.25 "	1.86 "
Cadmium volatilized in 30 mins.	0.09 "	7.52 "

Finding that cadmium volatilized readily under the action of the inductive current, a large quantity about 350 grains of the pure metal, was sealed up in the tube arranged as in Fig. 8, and the end of the tube containing the metal was heated to a little above the melting point; the molten metal being made the negative pole. In a few hours the whole quantity had volatilized and condensed in a thick layer on the far end of the tube, near, but not touching the positive pole.

Volatilization of Silver.—Small lumps of pure silver were cast on the ends of platinum wires, and suspended to the inner ends of platinum terminals passing through the glass bulb. The platinum wires were protected by glass, so that only the silver balls were exposed. The whole apparatus was enclosed in a metal box lined with mica, and the temperature was kept as high as the glass would allow without softening. The apparatus was exhausted to a dark space of 3mm., and the current was kept on for one and one-half hours. The weights of silver, before and after the experiment, were as follows:

	Positive pole.	Negative pole.
Original weight of silver	18.14 grs.	24.68 grs.
Weight after the experiment	18.13 "	24.44 "
Silver volatilized in 1½ hours.	0.01 "	0.19 "

It having been found that silver volatilized readily from the negative pole in a good vacuum, experiments were instituted to ascertain whether the molecules of metal shot off from the pole were instrumental in producing phosphorescence. A glass apparatus was made, as shown in Fig. 9. A pear-shaped bulb of German glass has, near the small end, an inner concave negative pole, A, of pure silver, so mounted that its inverted image is thrown upon the opposite end of the tube. In front of the pole is a screen of mica, having a small hole in the center, so that only a narrow pencil of rays from the silver pole can pass through, forming a bright spot of phosphorescence D, at the far end of the bulb. The exhaustion was pushed to a high point .00068 mm. or .9 M. The current from an induction coil was allowed to pass continuously for some hours, the silver pole being kept negative so as to drive off a certain portion of the silver electrode. On subsequent examination it was found that the silver had all been deposited in the immediate neighborhood of the pole, whilst at the far end of the tube the spot D, that had been continuously grow-

* Third Series, Vol. xii, p. 49, January, 1877, and Vol. xiv, p. 169, September, 1877.

*Cadmium melts at 320° and boils at 860°.

ing with phosphorescent light, was practically free from silver.

A tube was next made as shown in Fig. 10. It had two negative poles connected together, A A', so placed as to project two luminous spots on the phosphorescent glass of the tube. One of the electrodes, A', was of silver, a volatile metal; the other, A, was of aluminium, practically non-volatile. On connecting the two negative poles, A A', with the terminal of the coil, and the positive pole B, with the other terminal, it was seen in the course of half an hour that a considerable quantity of metal had been projected from the silver negative pole, blackening the tube in its neighborhood, while no projection of metallic particles took place from the aluminium positive pole. During the whole time of the experiment, however, the two patches of phosphorescent light, C and C', had been growing with exactly the same intensity, showing that the active agent in effecting phosphorescence was not the molecules of the solid projected from the poles, but the residual gaseous particles, or "radiant matter."

In the tubes hitherto made containing silver, it had not been easy to observe the spectrum of the negative pole, owing to the rapid manner in which the deposit obscured the glass. A special tube, Fig. 11, was therefore devised of the following character: The silver pole, A, was attached to the platinum pole at one end of the tube, and the aluminium positive pole, B, was at the side. The end of the tube opposite the silver pole was rounded, and the spectroscope was arranged to observe the light of the volatilizing silver "end on," as shown in the figure. In this way the deposit of silver offered no obstruction to the light, as none was deposited except on the sides of the tube surrounding the silver. At a vacuum giving a dark space of about three mm. from the silver, a greenish-white glow was seen to surround the metal. This glow gave a very brilliant spectrum. The spark from silver poles in air was brought into the same field of view as the vacuum glow, by means of a right-angled prism attached to the spectroscope, and the two spectra were compared. The two strong green lines of silver were visible in each spectrum; the measurements taken of their wave-lengths were 3,344 and 3,675, numbers which are so close to Thalén's numbers as to leave no doubt that they are the silver lines. At a pressure giving a dark space of two mm. the spectrum was very bright, and consisted chiefly of the two green lines and the red and green hydrogen lines. The intercalation of a Leyden jar into the circuit does not materially increase the brilliancy of the lines, but it brings out the well-known air lines. At this pressure not much silver flies off from the pole. At a higher vacuum, the luminosity round the silver pole gets less and the green lines vanish. At an exhaustion of about one-millionth of an atmosphere the luminosity is feeble, the silver pole has exactly the appearance of being red hot, and the volatilization of the metal proceeds rapidly.

(Like the action producing volatilization, the "red heat" is confined to the superficial layers of molecules only. The metal instantly assumes, or loses, the appearance of red heat the moment the current is turned on or off, showing that, if the appearance is really due to a rise of temperature, it does not penetrate much below the surface. The extra activity of the metallic molecules necessary to volatilize them is, in these experiments, confined to the surface only, or the whole mass would evaporate at once, as when a metallic wire is deflagrated by the discharge of a powerful Leyden jar. When this extra activity is produced by artificial heat, one of the effects is the emission of red light; so it is not unreasonable to imagine that when the extra activity is produced by electricity the emission of red light should also accompany the separation of molecules from the mass. In comparison with electricity, heat is a wasteful agent for promoting volatilization, as the whole mass must be raised to the requisite temperature to produce a surface action merely; whereas, the action of electrification does not appear to penetrate much below the surface.)

If, for the negative electrode, instead of a pure metal, such as cadmium or silver, an alloy was used, the different components might be shot off to different distances, and in this way make an electrical separation, a sort of fractional distillation. A negative terminal was formed of clean brass, and submitted to the electrical discharge *in vacuo;* the deposit obtained was of the color of brass throughout, and on treating the deposit chemically I could detect no separation of its component metals, copper and zinc.

Returning to the analogy of liquid evaporation, if we take several liquids of different boiling points, put them under the same pressure, and apply the same amount of heat to each, the quantity passing from the liquid to the gaseous state will differ widely in each case.

It was interesting to try a parallel experiment with metals, to find their comparative volatility under the same conditions of temperature, pressure and electrical influence. It was necessary to fix upon one metal as a standard of comparison, and for this purpose I selected gold, its electrical volatility being great, and it being easy to prepare in a pure state.

An apparatus was made as in Fig. 12. It is practically a vacuum tube with four negative poles at one end and one positive pole at the other. By a revolving commutator I was able to make electrical connection with each of the four negative poles in succession for exactly the same length of time (about six seconds); by this means the variations in the strength of the current, the experiment lasting some hours, affected each metal alike.

The exposed surface of the various metals used as negative poles were kept uniform by taking them in the form of wires that had all be drawn through the same standard hole in the draw-plate, and cutting them by gauge to a uniform length. The actual size used was 0.8 mm. in diameter, and 20 mm. long.

The comparison metal gold had to be used in each experiment. The apparatus thus enabled me to compare three different metals each time. The length of time that the current was kept on the revolving commutator in each experiment was eight hours, making two hours of electrification for each of the four negative electrodes. The pressure was such as to give a dark space of 6 mm.

The fusible metals—tin, cadmium and lead—when put into the apparatus in the form of wires, very quickly melted. To avoid this difficulty a special form of pole was devised. Some small circular porcelain basins were made, 9 mm. diameter; through a small hole in the bottom a short length of iron wire, 0.8 mm. in diameter, was passed, projecting downwards about 5 mm.; the basin was then filled to the brim with the metal to be tested, and was fitted into the apparatus exactly in the same way as the wires; the internal diameter of the basins at the brim was 7 mm. and the negative metal filled flat was thus formed of a circular disk 7 mm. diameter. The standard gold pole being treated in the same way, the numbers obtained for the fusible metals can be compared with gold, and take their place in the table.

The following table of the comparative volatilities was in this way obtained, taking gold as = 100:

Palladium	108.00	Platinum	44.00
Gold	100.00	Copper	40.00
Silver	82.68	Cadmium	31.99
Lead	75.04	Nickle	10.99
Tin	56.96	Iridium	10.49
Brass	51.58	Iron	5.50

In this experiment equal surfaces of each metal were exposed to the current. By dividing the numbers so obtained by the specific gravity of the metal, the following order is found:

Palladium	9.00	Copper	2.52
Silver	7.88	Platinum	2.02
Tin	7.76	Nickle	1.29
Lead	6.61	Iron	0.71
Gold	5.18	Iridium	0.47
Cadmium	3.72		

Aluminium and magnesium appear to be practically non-volatile under these circumstances.

The order of metals in the table shows at once that the electrical volatility in the solid state does not correspond with the order of melting points of atomic weights, or of any other well known constant. The experiment with some of the typical metals was repeated, and the numbers obtained did not vary materially from those given above, showing that the order is not likely to be far wrong.

It is seen in the above table that the electrical volatility of silver is high, while that of cadmium is low. In the two earlier experiments, where cadmium and silver were taken, the cadmium negative electrode in 30 minutes lost 7.52 grains, whilst the silver negative electrode in 1½ hours only lost 0.19 grains. This apparent discrepancy is easily explained by the fact (already noted in the case of cadmium) that the maximum evaporation effect, due to electrical disturbance, takes place when the metal is at or near the point of liquefaction. If it were possible to form a negative pole *in vacuo* of molten silver, then the quantity volatilized in a given time would be probably much more than that of cadmium.

Gold having proved to be readily volatile under the electric current, an experiment was tried with a view to producing a larger quantity of the volatilized metal. A tube was made having at one end a negative pole composed of a weighed brush of fine wires of pure gold, and an aluminium pole at the other end.

The tube was exhausted and the current from the induction coil put on, making the gold brush negative; the resistance of the tube was found to increase considerably as the walls became coated with metal, so much so, that to enable the current to pass through, air had to be let in after a while, depressing the gauge one-half mm.

The weight of the brush before experiment was 35.4940 grains. The induction current was kept on the tube for 14½ hours; at the end of this time the tube was opened and the brush removed. It now weighed 32.5613, showing a loss of 2.9327 grains.

MR. WALTER F. SMITH.

General Manager Heisler Electric Company, Philadelphia.

When heated below redness the deposited film of gold was easily removed from the walls of the tube in the form of very brilliant foil.

After having been subjected to electrical volatilization, the appearance of the residual piece of gold under the microscope, using a one-quarter inch object-glass, was very like that of electrolytically deposited metal, pitted all over with minute hollows.

This experiment on the volatilization of gold having produced good coherent films of that metal, a similar experiment was tried, using a brush of platinum as a negative electrode. On referring to the table it will be seen that the electrical volatility of platinum is much lower than that of gold, but it was thought that by taking longer time a sufficient quantity might be volatilized to enable it to be removed from the tube.

The vacuum tube was exhausted to such a point as to give a dark space of 6 mm., and it was found, as in the case of gold, that as a coating of metal was deposited upon the glass the resistance rapidly increased, but in a much more marked degree, the residual gas in the tube apparently becoming absorbed as the deposition proceeded. It was necessary to let a little air into the tube about every 30 minutes to reduce the vacuum. This appears to show that the platinum was being deposited in a porous spongy form, with great power of occluding the residual gas.

Heating the tube when it had become in this way non-conducting liberated sufficient gas to depress the gauge of the pump 1 mm., and to reduce the vacuum so as to give a dark space of about 3 mm. This gas was not re-absorbed on cooling, but on passing the current for 10 minutes the tube again refused to conduct, owing to absorption. The tube was again heated, with another liberation of gas, but much less than before, and this time the whole was reabsorbed on cooling.

The current was kept on this tube for 25 hours; it was then opened, but I could not remove the deposited metal except in small pieces, as it was brittle and porous.

NEWSPAPER ADVERTISING.

From the Investor's Point of View.

FIRST OF A SERIES OF ARTICLES ON THIS IMPORTANT BRANCH.

Below we present an article from the pen of Mr. Walter F. Smith, the general manager of the Heisler Electric Company, in which is given his views on newspaper advertising. Mr. Smith believes in "honest competition and liberal advertising" and points with pride to the number of creditable and successful technical publications that to-day are the exponents of the electrical industry.

In the next issue of the REVIEW we shall publish an article from another well known electrical gentleman, who yearly spends large sums in presenting his business to the public through the medium of the press.

General Manager Smith's Views.

To the Editor of Electrical Review:

When Benjamin Franklin sent his kite up among the clouds, we doubt if he had the remotest idea of the wonderful progress that would be made in the practical application of electricity in the nineteenth century. Human affairs have been revolutionized by this mighty force. Time and space would fail us if we should attempt even a brief enumeration of the wonderful things it has accomplished. We have seen achievements accomplished by its power that would almost seem incredible, and by the brilliancy of its shining light and the courageous and undaunted perseverance of the inventive genius, it has mounted to the summit of success.

It is generally admitted that the rapid development and application of the electrical science has been phenomenal. These results, we believe, are in a great measure due to the excellent facilities offered by the various able and enterprising electrical journals who have devoted their columns exclusively to electrical matters, and with the aid of their well organized staffs, have placed before the electrical fraternity and general public everything new electrically as rapidly as it has been developed.

We doubt if there is a business to-day that can boast of the same number of journals or advertising mediums as are devoted exclusively to the applications of electricity.

We believe in honest competition and liberal advertising. They are wise and instructive, forcing close calculations as well as keeping all the market contains fresh before us. We venture to state that there is no business in existence where competition is more keen than it is in the electrical business. Therefore, it is necessary that the individual who is entrusted with the management of an electrical enterprise, be equally as keen in his judgment as to the best methods of keeping his products before the public.

Even the meritorious article is slow to achieve success, unless it is backed up with judicious advertising coupled with a fair and liberal business policy, and the first important step of individual or corporation is to call to his aid the advertising medium that is possessed of the requisite qualifications to place his products intelligently in the field which they are designed to cover. These are the requisites which we believe are absolutely necessary for the successful enterprise. Yours truly,

Walter F. Smith.

Philadelphia, July 1, 1891.

KINDRED INTERESTS

The Partrick & Carter Company, Philadelphia, have issued a pamphlet giving a description of their Disque Leclanche battery, and a large number of testimonials as to its merits.

W. R. Ostrander & Company, Brooklyn, N. Y., have issued a handsome eighth edition of their revised catalogue of bell-hangers' hardware and electrical house-furnishing goods.

The Central Electric Company, Chicago, are receiving some very large orders for extra sizes of Okonite wire, and have recently taken several contracts for this wire running as high as 600,000 circular mils in diameter. The most of this is for underground and submarine work.

Woodhouse & Rawson United, Limited, London, write as follows:

"Mr. Charles A. Smith of the Athenæum, 71 Temple Row, Birmingham, has been appointed our agent for Birmingham and district, and has opened show-rooms at the address given, where samples of our goods may be seen, as well as local orders executed from stock."

Truex and Vail report that the following railroad companies and electric light stations have adopted their swinging ball lightning arrester since they have been handling it: The Ball Electric Light Company, of New York; The Hamilton and Lindenwald Electric Railroad, Hamilton, O.; The Federal Street and Pleasant Valley Railroad, Alleghany, Pa.; The Edison Company, Paterson, N. J.; The Danville Gas and Electric Light and Street Railway Company, Danville, Ill.; The Cincinnati Electric Light Company, Cincinnati, O.; Porter Rawlings, Helena, Ark., electric light station; The Canton Electric Light and Power Company, Canton, O.; The City of Ottawa, Ill., on their local plant; The Jenkintown Electric Light Company, Jenkintown, Pa.; Utica and Mohawk Railroad, Utica, N. Y.; The Lindell Railroad Company, St. Louis, Mo.; and the Edison Electric Light Company, at New Brunswick, N. J.

SHIPPING CLERK WANTS POSITION. Best of references; full knowledge of electrical supplies; export and domestic shipping; handling of men and material.

Address "Shipper,"

(CARE OF ELECTRICAL REVIEW.)

BURT & TOBEY WIRE COUPLING

NOW READY.

For Prices and Samples,

ADDRESS,

R. I. Telephone & Electric Co.,

PROVIDENCE, R. I.

JEWELS for scientific purposes. Sapphire and Agate Galvanometer Jewels. Sapphire Dies and Cutters for Fibres.

JOHN WENNSTROM,

COR. JOHN AND DUTCH STREETS, NEW YORK.

IF YOU have anything pertaining to electric machinery you want to sell, send us the description.

IF YOU want anything pertaining to electric machinery, send us your inquiries.

FRANK RIDLON & CO.,

Dealers in New and Second-Hand

Electric Light & Power Machinery,

196 SUMMER STREET, BOSTON.

FRICTION CLUTCH PULLEYS

AND

CUT-OFF COUPLINGS.

THE WOODCOCK CLUTCH.

Simplest and best in the world.

ADDRESS, ALLENTOWN FOUNDRY AND MACHINE CO., ALLENTOWN PA.

— THE —

REMINGTON Standard Typewriter.

Presents the practical results achieved by the best inventive and mechanical skill, aided by capital and the experience gained during the FIFTEEN YEARS in which it has been the

STANDARD WRITING-MACHINE OF THE WORLD!

Send for Illustrated Catalogue.

Wyckoff, Seamans & Benedict,

327 BROADWAY, N. Y.

PATENT PERFORATED

ELECTRIC LEATHER BELTING

MANUFACTURED BY

Charles A. Schieren & Co.,

45, 47, 49, 51 FERRY ST.,

COR. CLIFF ST.

BRANCHES:

BOSTON, 119 HIGH STREET.

PHILADELPHIA, 226 NORTH 3d STREET.

CHICAGO, 46 SOUTH CANAL STREET.

"A BIG HIT!"

AN ADJUSTABLE HAMMER

WE CLAIM this is the Best, Cheapest, Loudest Ringing and Handsomest Electric Bell in the United States.

WRITE FOR PRICES.

(Patent Applied For.)

HAY-HORN MFG. CO.,

63 South Canal Street,

NEW CATALOGUE READY. CHICAGO.

Eastern Agt., Jas. H. Mason, 120 Park Ave., B'klyn, N. Y.

THE LAW

Double Cylinder Battery.

Surface of negative element and quantity of solution double that found in any other open circuit cell.

Weigh carefully these advantages.

Its sale has steadily increased for ten years.

LAW TELEPHONE CO.,

Sole Makers,

87 JOHN STREET, NEW YORK.

MACHINERY IN STOCK.

Engine Lathes, 10 in. x 4 ft.; 11 in. x 5 ft.; 12 in. x 6 ft.; 14 in. x 6 ft.; 16 in. x 6 ft.; 18 in. x 8 ft.; 20 in. x 8 ft., with tapes attachment; 22 in. x 12 ft. and 14 ft.; 24 in. and 26 in. x 16 ft.; 30 in. x 10 ft. and 18 ft.; 36 in. and 38 in. x 20 ft.; 42 in. x 12 ft.; 56 in. x 18 ft.; 72 in. x 20 ft.; 108 in. x 22 ft. Fox Lathes, 13 in. x 5 ft.; 14 in. x 5 ft.; 15 in. x 6 ft.; 18 in. x 6 ft. Turret Lathes, 12 in. x 5 ft.; 14 in. x 5 ft.; 15 in. and 16 in. x 6 ft.; 18 in. x 6 ft.; 36 in. x 8 ft.

Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 72 in. x 60 in. x 15 ft.; 72 in. x 60 in. x 20 ft.

Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.

Crank Shapers, 6 in., 8 in., 10 in., 12 in., 15 in., 16 in., 20 in., 24 in., 28 in.

Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.

Screw Machines, Nos. 5, 6, 7, 8, Power Feed.

Presses, Nos. 51, 52, 53, Ferracute, Nos. 1, 2, 3, Stiles & Parker.

20 Lincoln Pattern Millers, No. 2.

Hand Millers, Nos. 1 and 2. 3 Cam Cutters.

Bolt Cutters, ¼ in. to 1 in., ¼ in. to 2 in.

2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.

1 New Horizontal Boring Machine. Newark Machine Tool Co.

Send for List of New and Second-Hand Machinery in Stock.

PRENTISS TOOL & SUPPLY CO., P. O. Box 3362.

115 Liberty Street, New York.

Burnley Dry Battery

PATENTED JAN., 1890.

STRONGER than any Open Circuit Battery on the Market. **BETTER** than any other Dry Battery yet produced. Most compact in size and cheapest. 90 cents per cell. Discount to the Trade and in quantities.

J. H. BUNNELL & CO.,

Sole Manufacturers and General Agents,

76 CORTLANDT ST., N. Y.

THE ELECTRICAL ENGINEERING COMPANY,

Contractors for Complete Arc, Incandescent and Power Plants.

ROOM 603, MONON BLOCK, 320 DEARBORN ST., CHICAGO, ILL.

Superintending Electrical Construction, and Advice on Electrical and Mechanical Subjects a Specialty.

"Magnetic Vane" Ammeters and Voltmeters.

THE best and cheapest instruments for Central Stations, Isolated Plants, Marine Installations and Electric Railways. Special Contracts made with Manufacturing Companies for supplying Ammeters and Voltmeters for use with their plants.

Correspondence Solicited.

Send for Descriptive Circular 235, and Catalogue I-66.

QUEEN & CO., Makers, Philadelphia.

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON JULY 7, 1891.

455,126 Electric post office box; Will. A. M. Smith and Robert T. F. Smith, Morrison, Ill.

455,138 Electric signal for steam vessels; Dyson D. Wass, San Francisco, Cal., assignor of one-half to Edwin W. Tucker, same place.

455,164 Apparatus for extracting gold and silver from their ores by electrical amalgamation; Geo. Button and William E. Wyeth, Kimberley, Griqualand, South Africa.

455,176 Apparatus for automatically regulating the firing of ordnance on ships; Manuel J. Cuadros, Liege, Belgium.

455,186 Apparatus for loosening tubes from mandrels; Alexander S. Elmore, Leeds, England.

455,187 Filament for incandescent electric lamps; George Erlwein, Berlin, Germany, assignor to Siemens & Halske, same place.

455,223 Lightning arrester; Frank Mansfield and Chas. W. Warren, Cleveland, O.

455,266 Electric railway signal; Winslow Stevens and Henry J. Hovey, New Haven, Conn., assignors to the Hall Signal Co., Portland, Me.

455,267 Automatic regulator for electric motors or dynamo-electric machines; Schuyler S. Wheeler, New York, N. Y., assignor to the Crocker-Wheeler Electric Motor Co., same place.

455,268 Telethermometer; Frederick W. Wiesebrock, New York, N. Y., assignor of one-half to Richard M. Bruno, same place.

455,287 Socket for incandescent electric lamps; Benjamin B. Keyes; Chelsea, Mass.

455,294 Printing telegraph; David H. Bates and Henry Van Hoevenbergh, New York, N. Y.

455,298 Electric locomotive; Norman C. Bassett, Lynn, Mass., assignor to the Thomson-Houston Electric Co. of Connecticut.

455,316 Annunciator; Manias Garl, Canton, O.

455,320 Telegraph key; Robert W. Green, St. Thomas, Canada.

455,322 Trolley pole stand; James R. Griffiths, Allegheny, Pa.

455,339 Conductor for electric railways; Walter H. Knight, Cleveland, O.

455,340 455,341 455,342 Electric railway. 455,343 Electric railway plow; Walter H. Knight, New York, N. Y.

455,352 Electrical watchman's clock; Harvey S. Park, Chicago, Ill.

455,366 Combined fuse block and incandescent lamp; Horace E. Swift, Boston, Mass.

455,398 Quadruplex telegraphy; Charles D. Haskins, Brooklyn, N. Y., assignor to the Western Electric Co., Chicago, Ill.

455,420 Method of electric welding. 455,421 Securing metal bands on wooden or other articles; Elihu Thomson, Swampscott, Mass., assignor to the Thomson Electric Welding Co. of Maine.

455,440 Watchman's time recorder; John A. Lannert, Cleveland, O.

455,446 Grave annunciator; William H. White, Topeka, Kan.

455,447 Conduit for electric railways; William Bradley, Fort Wayne, Ind.

455,451 Diaphragm for electrolytic cells; Ernest A. Le Sueur, Ottowa, Canada, assignor of one-half to Charles N. Walte, Newton, Mass.

455,454 Electric railway; Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Co. of Connecticut.

455,488 Friction gearing for dynamos; Frederick L. McGahan, Indianapolis, Ind.

455,510 Train signaling apparatus; Linwood F. Jordan, Somerville, Mass., assignor of one-half to Henry B. Bennett, Portland, Me.

455,517 Multipolar dynamo. 455,518 Carbon brush and holder therefor; Andrew L. Riker, New York, N. Y.

455,520 Pulsating current reciprocating electric engine system; Charles J. Van Depoele, Lynn, Mass.

455,524 Electric meter; James J. Wood, Brooklyn, N. Y.

455,532 Self-winding electric clock; Frederick L. Gregory, Niagara Falls, assignor of one-half to John G. Rich, Auburn, N. Y.

455,545 Electrical walking toy; John B. Kibler, Minneapolis, Minn.

456,559 Lamp socket and switch and circuit closer therefor; Henry P. Ball, Brooklyn, assignor to the Edison General Electric Co., New York, N. Y.

455,575 Electric meter. 455,576 Electric arc lamp; John W. T. Olan, New York, N. Y., assignor of one-half to Edward H. Johnson, same place.

455,581 Electric motor car truck; John F. Seiberling, Akron, O.

455,631 Apparatus for the defecation of saccharine juices by electricity in the manufacture of sugar; Elias Malgrot and José Sabates, Havana, Cuba.

455,680 Electric belt; Charles A. Bogardus, Syracuse, N. Y.

455,683 Transmission of alternating currents of different phase; Michael Von Dolivo Dobrowolsky, Berlin, Germany, assignor to the Allgemeine Elektricitats-Gesellschaft, same place.

455,693 Galvanic battery; Henry C. Sample, Ravenswood, assignor to Hugh W. Matthews, Chicago, Ill.

455,696 Switchboard for electric fence stations; David H. Wilson, assignor to the American Electric Fence Co., Chicago, Ill.

455,711 Electric motor; Lemuel G. Goode, Jersey City, N. J., assignor to the Paterson Electrical Manufacturing Co., of New Jersey.

455,722 Support for telephones; Wm. J. Myers, Allegheny, Pa., assignor to the R. D. Nuttall Co., same place.

455,726 Electric motor or generator; Walter F. Brown, St. Paul, Minn., assignor of two-thirds to William F. Bailey, George N. Bailey and Charles N. Nitteraner, all of same place.